NONCONFIDENTIAL

2013-1326

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

CHICAGO BOARD OPTIONS EXCHANGE INCORPORATED,
Plaintiff-Appellee,

v.

INTERNATIONAL SECURITIES EXCHANGE, LLC,
Defendant-Appellant.

Appeal from the United States District Court for the Northern District of Illinois in
No. 07-CV-0623, Judge Joan H. Lefkow

BRIEF OF APPELLANT

Parker H. Bagley
Michael S. DeVincenzo
Calvin E. Wingfield
GOODWIN PROCTER LLP
The New York Times Building
620 Eighth Avenue
New York, NY 10018-1405
Tel.: (212) 813-8800

Douglas J. Kline
GOODWIN PROCTER LLP
Exchange Place
53 State Street
Boston, MA 02109-2802
Tel.: (617) 570-1000

Laurel A. Kilgour
GOODWIN PROCTER LLP
3 Embarcadero Center, 24th Floor
San Francisco, CA 94111
Tel.: (415) 733-6000

Counsel for Appellant International
Securities Exchange, LLC

CERTIFICATE OF INTEREST

Counsel for International Securities Exchange, LLC certifies the following:

1.   The full name of every party represented by me is International Securities Exchange, LLC.

2.   The name of the real parties in interest represented by me is named in the caption.

3.   The parent corporation of International Securities Exchange, LLC ("ISE") is International Securities Exchange Holdings, Inc. ("ISEH"). ISEH's parent corporation is U.S. Exchange Holdings Inc. ("USEH"). USEH's parent corporation is Eurex Frankfurt AG ("Eurex Frankfurt"). Eurex Frankfurt's parent corporation is Eurex Zurich AG ("Eurex Zurich"). Eurex Zurich's parent corporations are Deutsche Borse AG ("Deutsche") and Eurex Global Derivatives AG. While no publicly owned company directly owns more than 10% of ISE's stock, Deutsche is a publicly owned German company that is listed on the Frankfurt Stock Exchange.

4.   The names of all law firms and the partners or associates that

appeared for the party now represented by me in the District Court, or are expected

to appear in this Court, are:

Parker H. Bagley	Christopher J. Gasper
Michael S. DeVincenzo	Jason M. Gonder
Douglas J. Kline	Chris L. Holm
Steven R. Gustavson	James Robert Klaiber
Calvin E. Wingfield	Michael Martin Murray
Laurel A. Kilgour	**MILBANK, TWEED, HADLEY &**
GOODWIN PROCTER LLP	**MCCLOY, LLP**

Michael D. Huber
Ronald L. Wisniewski
Kelly V. Milam
CRAY HUBER HORSTMAN
HEIL & VANAUSDAL

July 1, 2013   /s/Parker H. Bagley

TABLE OF CONTENTS

CONFIDENTIAL MATERIAL OMIITED

The material omitted on pages 24 and 25 of the brief are quotes concerning the accused system, CBOE*direct*, from documents designated confidential by appellee Chicago Board Options Exchange Incorporated.

TABLE OF AUTHORITIES

Page(s)

RULE 47.5(b) STATEMENT OF RELATED CASES

Chicago Board Options Exchange, Inc. v. International Securities Exchange, LLC, Nos. 2011-1267, 1298, was an earlier appeal before this Court from the same action being appealed here, Case No. 07-CV-0623 from the United States District Court for the Northern District of Illinois. On May 7, 2012, this Court reversed the district court's construction of the "system memory means" and "matching" claim limitations, vacated the judgment of non-infringement, and remanded for further proceedings. *Chicago Bd. Options Exchange, Inc. v. Int'l Securities Exchange, LLC*, 677 F.3d 1361 (Fed. Cir. 2012). The panel for that appeal comprised of Chief Judge Rader, Circuit Judge Wallach, and District Judge Fogel.

The following pending cases may be directly affected by this Court's decision in this appeal: *International Securities Exchange, LLC v. Chicago Board Options Exchange, Inc.*, Case No. 07-cv-4709 (N.D. Ill.) and *C2 Options Exchange v. International Securities Exchange, LLC*, Case No. 10-cv-06483 (N.D. Ill.).

JURISDICTIONAL STATEMENT

The United States District Court for the Northern District of Illinois had jurisdiction over this case under 28 U.S.C. §§ 1331 and 1338(a). On March 22, 2013, the parties stipulated to non-infringement based on the district court's pre-trial rulings, and the district court entered Final Judgment on April 10, 2013. On April 12, 2013, ISE timely filed a notice of appeal under 28 U.S.C. § 2107. This Court has jurisdiction under 28 U.S.C. § 1295(a)(1).

STATEMENT OF THE ISSUES

1.   Whether the district court on remand erred in ruling *in limine* that ISE may not assert that CBOE*direct* is the accused system in this case.

2.   Whether the district court on remand violated this Court's mandate by further construing this Court's construction of the term "automated exchange."

3.   Whether the district court on remand violated this Court's mandate by construing this Court's construction of the term "matching" to require completion of all "matching" steps before any "allocating" steps may begin.

4.   Whether the district court on remand erred in ruling that claim 2 is invalid as indefinite.

5.   Whether the district court on remand erred in construing limitations directed to "allocating" or "matching" "preferentially against previously received professional orders and quotations with larger size" in claims 1 and 35, respectively, to require a "sequential filling of orders" from largest to smallest.

6.   Whether the district court on remand erred in precluding ISE from relying on evidence of CBOE's infringement of dependent claim 58 to satisfy ISE's burden of proving infringement of independent claim 56.

STATEMENT OF THE CASE

This is the second appeal from a patent infringement dispute between International Securities Exchange, LLC ("ISE") and Chicago Board Options Exchange Incorporated ("CBOE") regarding ISE's United States Patent 6,618,707 ("the '707 patent"), entitled "Automated Exchange for Trading Derivative Securities."[1] ISE sued CBOE for infringing the '707 patent in the Southern District of New York. A1554-57; *Chicago Bd. Options Exchange, Inc. v. Int'l Securities Exchange, LLC*, 776 F. Supp. 2d 606, 608 (N.D. Ill. 2011); A6296. CBOE then sued ISE in the Northern District of Illinois for a declaratory judgment of non-infringement, and ISE's suit was transferred to that court. A1579-83; *Chicago Bd.*, 776 F. Supp. 2d at 608; A6296.

In March 2011, the district court granted CBOE's motion for summary judgment of non-infringement based upon its constructions of the terms "system memory means" and "matching." *See Chicago Bd.*, 776 F. Supp. at 612-16; A6305-11. The district court denied CBOE's motion regarding the "automated exchange" limitation, holding that whether the accused system, CBOE*direct*, is an "automated exchange" presents a disputed issue of material fact. *See Chicago Bd.*, 776 F. Supp. 2d at 612; A6304.

---

[1] The first appeal was Appeal Nos. 2011-1267, 1298.

This Court reversed the district court's construction of the "system memory means" and "matching" claim limitations, vacated the judgment of non-infringement, and remanded for further proceedings. *Chicago Bd. Options Exchange, Inc. v. Int'l Securities Exchange, LLC*, 677 F.3d 1361 (Fed. Cir. 2012). The Court also reversed the district court's construction of "automated exchange." *Id.* at 1373.

On remand, the district court precluded ISE from accusing CBOE*direct*—the system that ISE identified as the accused product in 2009—of meeting the "automated exchange" limitation and thus infringing the '707 patent. A5-8; A22. Instead, the district court held that CBOE's Hybrid system—a network of computers including both the servers used by CBOE*direct* and the separate computers used by CBOE's partially automated floor-based (or open-outcry) trading system—is the accused product, and required that ISE show that the Hybrid system rather than CBOE*direct* is an "automated exchange." A5-8; A22.

That pretrial ruling (and several others discussed below) made it impossible for ISE to prove at trial that CBOE infringes the '707 patent. Accordingly, ISE stipulated to non-infringement and the invalidity of claims 2, 4 and 5 (A12635-38), whereupon the district court entered final judgment for CBOE. A1-4. The validity of claims 4 and 5 is not an issue in this appeal.

STATEMENT OF THE FACTS

I. The Parties

Headquartered in New York City, ISE began operations in May 2000 as the first all-electronic options exchange in the United States. A1554; A729, A836[¶2]; A1006; A1130. In less than two years it was an industry leader in market share and volume for equity options trades. *See* A837-38[¶¶4-5] (citing, *inter alia*, A1136-37; A1138-40; A1163-65; A1170-71; A1172; A1173-75; A1184-1221 (Harvard Business School case study on ISE)). A driving force behind ISE's meteoric rise was its patented technology at dispute here. A1130-1132.

CBOE, headquartered in Chicago, Illinois, is one of ISE's largest competitors.

II. The '707 Patent

The '707 patent relates to an exchange that "automatically matches incoming orders and quotations with * * * stored orders and quotations." A143[5:60-65]. The patent discloses various processes for matching incoming orders and quotations with previously received ones stored in memory based on a number of rules (or allocating parameters) for dividing the incoming orders. *See* A145[9:62-10:8]; A147[14:51-58]; A155[29:53-30:14]. All orders and quotations, including incoming ones and previously received ones, are required to have an associated size that represents the number of contracts a person is willing to buy or sell. Often the size of the incoming order or quotation may be less than the total size of the previously received orders or

5

quotations stored in memory. When that happens, rules are needed for allocating the incoming order or quotation among the previously received orders and quotations.

The '707 patent discloses a unique system for matching an incoming order or quotation to the previously received orders or quotations at the best price. First, an incoming order or quotation is matched based on time priority to previously received public "customer" (*i.e.,* non-professional) orders stored in memory. A147[14:58-64]; A143[5:66-6:2]. This time priority allocating parameter rewards those orders or quotations received first in time by first allocating portions of an incoming order or quotation up to the amount they are willing to trade, *i.e*. their size. *See* A147[14:58-64].

After an incoming order is matched based on time priority to the previously received public customer orders, any remainder is matched to previously received professional orders or quotations. A143[5:65-5:3]. The '707 patent discloses that the remaining portion of the incoming order is matched "preferentially" based on size to those previously received professional orders or quotations. A disclosed example of this preferential allocation based on size is a pro rata allocation. A147[14:51-58]. A pro rata allocation results in each previously received professional order and quotation receiving a portion of the incoming order or quotation that is proportional to the size of the previously received order or quotation. A149-50[18:1-8, 18:61-9:4].

6

In short, the "automated exchange" begins the "matching" process by identifying the previously received (or "existing") orders or quotations that are at the best price for the incoming order or quotation and are therefore *eligible* for a trade; uses an allocating process to determine what portion of the incoming order or quotation the eligible existing orders or quotations may receive; and completes the "matching" process by identifying particular portions of the incoming order with particular existing orders. *See* A147-48[14:51-15:13, 16:13-67]; A149[17:1-23].

III.   The Asserted Claims

ISE asserts claims 1-2, 3, 6, 9-10, 35-36, 43, 45, and 56 against CBOE. Claim 1 is representative of the asserted apparatus claims. Independent claim 1 recites (among other things):

> *An automated exchange* for trading a financial instrument wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:
>
> * * * the allocating parameters include parameters for * * * allocating a remaining portion of the incoming order or quotation *preferentially against professional orders and quotations with larger size*.

A155[29:53-30:14] (emphasis added).

Claim 2 depends from claim 1 and recites a "means for matching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis." A155[30:15-18].

Independent claim 35 recites "[a] process for trading a financial instrument on an automated exchange" comprising, among other things,

> first *matching a first portion* of the incoming order or quotation against the public customer order stored in the book memory *based on the allocating parameter*; and

> second *matching a remaining portion* of the incoming order or quotation *preferentially against professional orders and quotations with larger size based on the allocating parameter*.

A158[35:23-47] (emphasis added).

Independent claim 56 recites "[a] process for trading a financial instrument on an automated exchange" comprising, among other things, "querying an away market to determine an away market price." A160[39:1-26].

IV.   CBOE's Accused System For Executing Trades

CBOE is a registered exchange that primarily uses two systems for executing trades. *Chicago Bd.*, 776 F. Supp. 2d at 609; A6298; A10422. One is a fully computerized system called CBOE*direct*. *Chicago Bd.*, 776 F. Supp. 2d at 609; A6298; A10422. The other is a partially automated floor-based, or "open outcry," system. *Chicago Bd.*, 776 F. Supp. 2d at 609; A6298; A10422. CBOE refers to the entirety of its trading operations as a Hybrid "market model" or a "Hybrid System." A4599-4600; A10420; *see also Chicago Bd.*, 776 F. Supp. 2d at 609; A6298-99. ISE identified CBOE*direct* as an accused system in its infringement contentions served in January 2009. A9952, A9953-55, A9970. Ninety-two percent of the

8

orders traded by CBOE are executed electronically using CBOE*direct*, while the remaining 8 percent are executed using CBOE's partially automated floor-based system. *Chicago Bd.*, 776 F. Supp. 2d at 612 (quoting A4150, A4152); A6303 (same).

All trades executed by CBOE*direct* are executed using a computer algorithm—the Ultimate Matching Algorithm ("UMA")—which matches portions of an incoming order or quotation to previously received orders and quotations. *See Chicago Bd.*, 776 F. Supp. 2d at 609; A6299; A5207, A5221[58:13-59:23]; A4995, A5005[¶0038]; A10422. CBOE*direct* uses the identical algorithm disclosed in the '707 patent for the identical reasons. CBOE*direct* first matches portions of an incoming order or quotation to previously received public customer orders based on time priority. *Chicago Bd.*, 776 F. Supp. 2d at 609-10; A6299; A5221[58:13-59:23]; A5005[¶0038]. If a portion of the incoming order or quotation remains, CBOE*direct* matches on a pro rata basis that portion to previously received professional orders and quotations. *Chicago Bd.*, 776 F. Supp. 2d at 609-10; A6299; A5221[58:13-59:23]; A5005[¶0038]. All trades are executed by CBOE*direct* in a fully computerized manner without matching or allocating in open outcry.

V.   The District Court's First Opinion

When this case was first before the district court, CBOE moved for summary judgment of non-infringement based on the district court's construction of the terms

"system memory means," "matching," and "automated exchange." *Chicago Bd.*, 776 F. Supp. 2d at 610; A6301. The district court granted the motion with respect to the first two terms, holding that the accused trading system, CBOE*direct*, did not satisfy the "system memory means" limitation of the asserted apparatus claims and did not perform the "matching" steps of the asserted method claims. *Chicago Bd.*, 776 F. Supp. 2d at 612-16; A6305-11. In particular, the district court construed the "matching" of incoming orders and quotations to existing orders and quotations to be based on price alone. *Chicago Bd.*, 776 F. Supp. 2d at 614-15; A6309-10.

The district court denied CBOE's motion with respect to the term "automated exchange." *See Chicago Bd.*, 776 F. Supp. 2d at 612. It held that ISE had raised "a genuine material issue as to whether, under the court's construction [of "automated exchange"], CBOEdirect may be considered an exchange separate from the open outcry aspects of Hybrid. Although part of Hybrid, CBOEdirect was initially designed to function independently. * * * Whether CBOE considers Hybrid to be one fully integrated system or a combination of two is itself unclear." *Chicago Bd.*, 776 F. Supp. 2d at 611; A6302-03. The district court concluded that, "because there are disputed material issues as to whether CBOEdirect can be considered an independent exchange, it is a jury question not appropriate for summary judgment." *Chicago Bd.*, 776 F. Supp. 2d at 612; A6304.

10

Although the district court denied CBOE summary judgment with respect to the "automated exchange" limitation, ISE appealed the district court's construction of that term, which was: "[a] method that effects trades of financial instruments by automatically matching and allocating but also permits matching and allocating through 'oral communications between market professionals at a central location in open view of other market professionals' * * * is not fully computerized and therefore not 'automated.'" *Chicago Bd.*, 776 F. Supp. 2d at 611; A6301-02.

VI.   This Court's Decision

This Court reversed the district court's construction of the "system memory means" and "matching" claim limitations and vacated the judgment of non-infringement. *Chicago Bd.*, 677 F.3d at 1366-75. The construction of "system memory means" is no longer an issue in the case. This Court construed "matching" to mean "identifying a counterpart order or quotation for an incoming order or quotation" and further "h[e]ld that 'matching' is a process that is distinct from 'allocating.'" *Id.* at 1371.

Because the construction of "automated exchange" would arise on remand, this Court also reversed the district court's construction of that term. This Court construed the term to mean "a system for executing trades of financial instruments that is fully computerized, such that it does not include matching or allocating through the use of open-outcry." *Id.* at 1373. That construction incorporates this

11

Court's finding that the '707 patent disavows "traditional open-outcry or floor-based trading systems." *See id.* at 1372-73.

VII.   The District Court's Rulings On Remand

Although, in its first opinion, the district court denied CBOE's motion regarding the "automated exchange" limitation, holding that "there are disputed material issues as to whether CBOE*direct* can be considered an independent exchange," which presented "a jury question not appropriate for summary judgment" (*Chicago Bd.*, 776 F. Supp. 2d at 612; A6304), on remand the court ruled *in limine* that ISE was precluded from accusing CBOE*direct* of meeting the "automated exchange" limitation and thus infringing the '707 patent. A5-8; A22. Instead, the district court held that CBOE's Hybrid system is the accused product that ISE must prove is an "automated exchange." A5-8; A22. Given this Court's construction of an "automated exchange" as one that "does not include matching or allocating through the use of open-outcry," that ruling effectively granted summary judgment of non-infringement.

The district court also ruled that ***all*** steps of the "matching" process must occur before the "allocating" processes may begin, and that the "means for matching" limitation of claim 2 is invalid as indefinite under 35 U.S.C. § 102(f). A13 n.2; A21-22.

The district court also construed the "preferentially" limitations of claims 1-3, 6, 9-10, 35, 36, 43, and 45 to require a "sequential filling of orders" from largest to smallest (A20; A24), and precluded ISE from relying on evidence that the accused product, CBOE*direct*, satisfied a limitation recited in dependent claim 58 to establish that CBOE*direct* satisfied the querying step in the independent claim 56, the claim from which claim 58 depends. A23.

In the face of these rulings, ISE stipulated to non-infringement and the invalidity of claims 2, 4 and 5 (A12635-38),[2] the district court entered final judgment for CBOE, and this appeal followed. A1-4.

---

[2] ISE is not appealing the district court's judgment that claims 4 and 5 are invalid as indefinite.

SUMMARY OF THE ARGUMENT

The district court violated this Court's mandate by further construing this Court's constructions of the "automated exchange" and "matching" claim limitations and incorrectly construed other claim limitations identified below. Those errors led the district court to rule *in limine* and preclude ISE from presenting evidence that, under this Court's constructions and the proper construction of the asserted claims, the accused product, CBOE*direct*, infringes the '707 patent.

1. The accused product, CBOE*direct*. In its first decision in this case, the district court ruled that CBOE's "Hybrid" system—the name CBOE gives to the combination of various systems including, CBOE*direct*, a fully computerized system for executing trades and its floor-based (open-outcry) system—includes open outcry and therefore does not infringe the '707 patent, which disavows traditional open-outcry trading. The district court also ruled that whether CBOE*direct* is an "automated exchange" presents a disputed issue of material fact for a jury to decide. In its ruling below, however, after first acknowledging that CBOE*direct* is the accused product, the district court *sua sponte* reversed course and held that CBOE Hybrid is the accused product—a ruling that effectively granted summary judgment to CBOE. That ruling should be reversed because, as the district court correctly ruled in its first opinion, whether CBOE*direct* is an "automated exchange" in its own right—a proposition strongly supported by the record evidence—is a question of fact

14

that the district court erroneously took from the jury. *See Lemelson v. TRW, Inc.*, 760 F.2d 1254, 1260-61 (Fed. Cir. 1985) ("[A]ny doubt as to the presence or absence of disputed issues of material fact must be resolved in favor of the presence of disputed issues * * *.").

    2. **"Automated Exchange."** This Court construed the term "automated exchange" and remanded for further proceedings based on that construction. *Chicago Bd.*, 677 F.3d at 1373, 1375. On remand, the district court issued a self-contradictory ruling. As noted, it held that CBOE Hybrid must be the accused product. *See* A5-8; A22. Yet, treating CBOE*direct* as the accused product, the district court also impermissibly construed this Court's construction and altered ISE's burden of proof by requiring ISE to prove that CBOE*direct* is "independent" of and not "integrated" with CBOE's trading floor and that CBOE's "order routing" algorithm does not include matching or allocating through the use of open outcry. *See* A5-8. The district court had no power to further construe this Court's construction or alter the question of fact defined by that construction. *See E-Pass Techs., Inc. v. 3Com Corp*, 473 F.3d 1213, 1220 (Fed. Cir. 2007) ("[T]he terms courts use to enunciate the proper construction of a claim are not themselves limitations that require interpretation."). Given this Court's construction, and rightly treating CBOE*direct* as the accused product, ISE does not have the burden to prove "independence" or to disprove "integration" or to address Hybrid's rule-based order

routing algorithm or to mention Hybrid at all. Rather, it must prove only that CBOE*direct* is as "automated exchange" as defined by this Court, *i.e.,* "a system for executing trades of financial instruments that is fully computerized, such that it does not include matching or allocating through the use of open-outcry." *See Chicago Bd.*, 677 F.3d at 1373.

      3. "Matching." The district court violated this Court's mandate by interpreting this Court's construction to require completion of *all* steps in the "matching" process before any steps of the "allocating" process may begin. A13 n.2; A21-22. *See E-Pass*, 473 F.3d at 1220. The district court's interpretation flatly contradicts this Court's rationale for rejecting the district court's initial construction of "matching" as based on price only—that the '707 patent discloses "matching" based on allocating parameters (e.g., time, size or pro rata) that allocate portions of an incoming order or quotation to previously received orders and quotations. *Chicago Bd.*, 677 F.3d at 1371. In such a circumstance, the "match" of the two orders must occur *after* allocating has begun.

      4. "Means for Matching * * * on a Pro Rata Basis." The district court erroneously held that claim 2 is invalid as indefinite under 35 U.S.C. § 102(f). A21-22. Claim 2 depends from claim 1 and recites a limitation directed to a "means for matching [a] remaining portion with professional orders or quotations in the book memory means on a pro rata basis." A155[30:15-18]. In reversing the district

16

court's construction of "matching" as being based on price only, this Court held that the '707 patent disclosed matching on a pro rata basis. *Chicago Bd.*, 677 F.3d at 1370. Yet, the district court on remand held that the '707 patent discloses only "allocating on a pro rata basis." A21-22. Because the district court disregarded this Court's holding, the court failed to recognize the four-step algorithm disclosed in the '707 patent for "matching [a] remaining portion with professional orders or quotations in the book memory means on a pro rata basis" as recited in claim 2.

5.   **The "preferentially" limitation.** Claim 1 describes a system for executing trades that first satisfies existing customer orders and then uses parameters for "allocating a remaining portion of the incoming order or quotation preferentially against [existing] professional orders and quotations with larger size" (the "preferentially limitation"). A155[30:12-15]. Under that system, the larger the existing professional order, the larger its share of the "remaining portion" of the incoming order. The district court's construction of that limitation to require "a sequential filling of orders" from largest to smallest—under which an existing large order could receive *all* of "the remaining portion of the incoming order" rather than a "portion" of that order—was based on a fundamental misunderstanding of the doctrine of claim differentiation. A20; A24 n.1. Because the district court's construction contradicts the plain claim language of independent claims 1 and 35

17

(and their dependent claims 2, 3 and 35), and excludes disclosed embodiments of those claims, it is incorrect and should be reversed.

 6. **The "querying" limitation.** The district court's judgment of non-infringement of claim 56 should be reversed because the court misapplied the doctrine of claim differentiation in precluding ISE from relying on CBOE's use of "price information from a reporting entity" to establish that CBOE*direct* performed the "querying" step of claim 56. A23. Claim 56 recites "***querying*** an away market to determine an away market price." A160[39:21-22]. Claim 58 depends from claim 56 and further recites "the ***step of querying*** further ***comprises*** receiving market price information from a reporting entity." A160[39:38-40]. Thus, contrary to the district court's holding, claim 58 expressly states that the "querying" step of claim 56 may be performed using price information from a reporting entity, which is what CBOE*direct* does.

 If the Court agrees with any or all of these arguments and reverses the judgment below, it should remand with instructions that the case be reassigned to a different judge, in keeping with settled precedent of the Seventh Circuit Court of Appeals.

ARGUMENT

I.   STANDARD OF REVIEW

A district court's claim construction presents a question of law that is reviewed *de novo* on appeal. *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1456 (Fed. Cir. 1998) (en banc). A grant of summary judgment is also reviewed *de novo* on appeal, with all reasonable inferences drawn in favor of the non-moving party. *Bell Atl. Networks Servs., Inc. v. Corad Commc'ns Group, Inc.*, 262 F.3d 1258, 1266-67 (Fed. Cir. 2001). This Court also reviews *de novo* a district court's interpretation of this Court's mandate. *Tronzo v. Biomet, Inc.*, 236 F.3d 1342, 1346 (Fed. Cir. 2001); *Engel Indus. v. Lockformer Co.*, 166 F.3d 1379, 1382 (Fed. Cir. 1999); *Laitram Corp. v. NEC Corp.*, 115 F.3d 947, 950 (Fed. Cir. 1997).

II.   THE DISTRICT COURT ERRED IN HOLDING THAT "CBOE HYBRID" IS THE ACCUSED PRODUCT AND PRECLUDING ISE FROM ACCUSING CBOE*DIRECT* OF INFRINGEMENT

In its first decision in this case concerning summary judgment, the district court denied CBOE's motion with respect to the term "automated exchange" because it ruled that a jury must decide the material factual dispute over whether CBOE*direct* "may be considered an exchange separate from the open outcry aspects of Hybrid"—the name given by CBOE to the various computers used in its trading operations. *Chicago Bd.*, 776 F. Supp. 2d at 611-12; A6302-04. The district court noted that "CBOE maintains that only Hybrid is at issue, while ISE [asserts] * * *

19

that Hybrid consists of two exchanges, CBOEdirect and open outcry, and that

CBOEdirect infringes the '707 patent." *Chicago Bd.*, 776 F. Supp. 2d at 611

(footnote omitted); A6302 (same). "This difference is material," the court added,

because "Hybrid uses both electronic and floor-based trading * * * and so Hybrid

does not infringe the '707 patent." *Chicago Bd.*, 776 F. Supp. 2d at 611; A6302.

The district court then noted that "[w]hether CBOE considered Hybrid to be

one fully-integrated system or a combination of two is itself unclear" and that

"Hybrid has been touted both internally and externally as giving customers 'a choice

between a pure electronic system, offering sub-second execution, and open outcry.'"

Chicago Bd., 776 F. Supp. 2d at 611-12; A6303. Moreover, "'[n]inety-two percent

of the orders traded on CBOE's Hybrid Trading System are executed electronically

* * *.'" *Chicago Bd.*, 776 F. Supp. 2d at 612 (quoting A4152); A6303.

Accordingly, the district court held that, "because there are disputed material

issues as to whether CBOEdirect can be considered an independent exchange, it is a

jury question not appropriate for summary judgment." *Chicago Bd.*, 776 F. Supp. 2d

at 612; A6304.

On remand from this Court's decision, the district court initially recognized

that CBOE*direct* was the accused product, saying that "ISE will argue that

CBOEdirect infringes because it is an automated exchange" and "CBOE will argue

that CBOEdirect is not an automated exchange." A10350, A10351. But then the

district court reversed itself and effectively granted CBOE summary judgment by

holding that Hybrid is the accused product and forbidding ISE from arguing

otherwise. A5-8; A22. Thus, in granting in part CBOE's Motion *In Limine* No. 1,

the district court ruled:

> The issue for trial is whether Hybrid is merely two
> independent exchanges, one an "automatic exchange"
> (CBOEdirect) and the other open outcry on the trading
> floor, or whether it is an integrated system that requires
> interaction with the trading floor. As such, ISE will have
> the burden to demonstrate (1) that each element * * * of
> one or more claims is present in CBOEdirect, and (2) that
> Hybrid's "rule-based order routing algorithm" does not
> include matching or allocating through open outcry. * * *
> In other words, ISE must prove that Hybrid is a system for
> executing trades of financial instruments that is fully
> computerized, such that it does not include matching or
> allocating through the use of open outcry.
>
> ISE may offer evidence that the elements of the
> claims of the '707 patent are found in CBOE direct but it
> may not argue that, therefore, CBOEdirect infringes or that
> Hybrid's algorithm that includes routing orders to the
> trading floor is irrelevant.

A5 (footnote omitted).

The first and third sentences of that passage flatly contradict each other: the

first requires ISE to prove that Hybrid is "two independent exchanges," while the

third requires it to prove that Hybrid "is fully computerized." In addition, as we

show in Part III below, this ruling impermissibly changed this Court's construction

of "automated exchange."

For present purposes, however, the most egregious effect of this ruling was that it required ISE to prove a fact that the district court had already resolved against ISE—that Hybrid does not include open outcry—and resolved a disputed issue of material fact—whether CBOE*direct* is an "automated exchange"—that the district court had already held was for the jury.

As noted above, the district court in its March 3, 2011 decision had ruled that "Hybrid uses both electronic and floor-based trading * * * and so Hybrid does not infringe the '707 patent." *Chicago Bd.*, 776 F. Supp. 2d at 611; A6302. The district court had also ruled that "there are disputed material issues as to whether CBOEdirect can be considered an independent exchange" and therefore "it is a jury question not appropriate for summary judgment." *Chicago Bd.*, 776 F. Supp. 2d at 612; A6304. Given those earlier rulings, ISE reasonably sought reconsideration or clarification of the district court's latest ruling, based on the presumption that the reference to Hybrid was a scrivener's error. A10538; A10530-36. The district court confirmed that its reference to Hybrid was intentional and that it would not permit ISE to assert that CBOE*direct* is the accused system:

> The patented process is a system for executing trades.
> Hybrid is a system for executing trades. And these are the
> two apples that we're going to compare.

A11133, A11138-43[9:6-10]; *see also* A22; A11328, A11405-06[151:24- 152:1] ("I

don't know what more I can say about that that I think the accused system is

hybrid.").

The district court was not authorized to resolve the factual question

concerning the relationship between CBOE*direct* and Hybrid and whether

CBOE*direct* is an "automated exchange." It accurately held in its earlier decision

that that issue presents a jury question, and the evidence of record strongly supports

the conclusion that a reasonable juror could find that CBOE*direct* is in fact "a

system for executing trades" and an "automated exchange."

The evidence shows CBOE*direct* is a "system for executing trades" and that

all trades executed by CBOE*direct* are executed by computers using CBOE's

Ultimate Matching Algorithm—an algorithm for matching and allocating trades

among previously received public customer orders and professional orders and

quotations. *Chicago Bd.*, 776 F. Supp. 2d at 609, 611-12; (citing A10485-86

("CBOEdirect™ is a trading system that includes a trading engine with an order

book. CBOEdirect takes in quotes and orders, executes those that match,

disseminates market data (quotes and last sales), and places (unexecuted) quotes and

orders in the book.")); A6299; A6303; A4152. None of the trades executed by

CBOE*direct* includes "matching or allocating through the use of open-outcry." *See*

Chicago Bd., 776 F. Supp. 2d at 611-12; A6303; A4152; A4162; A10468-70,

23

MATERIAL SUBJECT TO PROTECTIVE ORDER REDACTED

A10472; A10422; A4162; A4179-80[¶¶ 9, 12]; A4183, A4186 ("{

}"—"{

}")

(emphasis added); A4233, A4237 ("{

}") (emphasis

added); A4250, A4256 ("{

}")

(emphasis added).

The only interaction between CBOE*direct* and CBOE's floor-based trading system is CBOE's order routing algorithm that routes orders or portions of orders to both CBOE*direct* and CBOE's floor-based system. The trades executed using CBOE's trading floor are executed using a system for executing trades other than CBOE*direct*. CBOE Holding, Inc.—the parent company for CBOE—has stated it best: CBOE "[o]ffer[s] market participants an efficient, transparent and liquid marketplace for ***trading options*** both ***through traditional open outcry methods*** and ***through our electronic platform, CBOEdirect***." A4143 (emphasis added); *see also* A4146. Also, CBOE's Chairman and CEO William J. Brodsky and Vice Chairman Edward T. Tilly have recognized that the Hybrid offers two trade execution systems: "CBOE's hybrid system provides customers with a choice between [1] a pure

24

MATERIAL SUBJECT TO PROTECTIVE ORDER REDACTED

electronic system [([CBOEdirect]), offering sub-second execution, and [2] open

outcry for those customers preferring the superior liquidity and price discovery

found in an open outcry forum." A10395. Further, CBOE's annual reports, SEC

filings, and internal documents emphasize that CBOE has two distinct systems for

executing systems or "exchanges" and that one of those systems is fully

computerized. *See* A10407; A10416-417; A10422 ("{

}").

ISE's expert Dr. Ma relied on CBOE's admissions, as well as numerous other

documents, to support his opinion that one of skill in the art would readily recognize

that CBOE operates two systems for executing trades or exchanges. A10432-

36[¶¶175-179]. CBOE's own technical expert, Dr. Benn Steil, conceded that

CBOE*direct* "includes a system for executing trades," *i.e.*, an "exchange." A10460,

A10463[106:25-108:4]. He also conceded that CBOE*direct* executes trades in a

"fully computerized manner" (A10461[28:9-22]) and that CBOE*direct* does not use

"human beings [for] executing trades," *i.e.*, open outcry. A10463[106:25-107:7].

That an order (or a portion thereof) may be routed between CBOE*direct* and a

partially automated floor-based system does not transform CBOE*direct* from an

"automated exchange" or system for executing trades that "does not include

matching or allocating through the use of open-outcry" into one that does. Instead, it

merely evidences that CBOE uses both a fully computerized exchange (CBOE*direct*,

which does not include disavowed subject matter) and a partially automated or floor-based exchange (which includes disavowed subject matter). Accordingly, this Court's construction of "automated exchange" does not preclude ISE from accusing CBOE*direct* of infringing merely because CBOE uses an order routing algorithm that routes orders between its two systems for executing trades. *See, e.g., N. Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 945 (Fed. Cir. 1990) ("The addition of features does not avoid infringement, if all the elements of the patent claims have been adopted."); *A.B. Dick Co. v. Burroughs Corp.*, 713 F.2d 700, 703 (Fed. Cir. 1983) ("It is fundamental that one cannot avoid infringement merely by adding elements if each element recited in the claims is found in the accused device.").

Nothing in this Court's opinion suggests that the '707 patent disavows "order routing" between a fully computerized system for executing trades, such as CBOE*direct*, and a partially automated floor-based or open-outcry system.[3] That is because order routing *is not* trade execution, let alone matching or allocating through the use of open outcry. A10436-38[¶ 181]. The district court cited *BASF Agro B.V. v. Makhteshim Agan of N. Am., Inc.*, No.1:10-cv-276, 2012 WL 84985

---

[3] Not only did CBOE fail to argue during the first appeal that the '707 patent disavowed "order routing," but also CBOE argued that the disavowal in the '707 patent required only "automatically matching and allocating" and that unclaimed steps, such as order routing, were "not in any way implicate[d]" by the disavowal. A11933, A12004-05. CBOE also represented that actions that occur outside an "automated exchange" are "totally extraneous to the 'automated exchange' of the patent." *Id.*

(M.D.N.C. Jan. 11, 2012), aff'd No. 2012-1206, 2013 WL 1136714 (Fed. Cir. March 20, 2013), in one of its orders concerning the accused product (A7), but in that case the accused product encompassed disclaimed subject matter, whereas here, as shown above, CBOE*direct*, does not "include matching or allocating through the use of open-outcry" and therefore does not encompass disclaimed subject matter. As CBOE's Rule 30(b)(6) deponent explained, the order routing process "isn't part of the trading logic," and as such, is "separate" from trade execution. A10449, A10451-52[218:16-219:9].

In short, the evidence would permit a reasonable jury to find that CBOE*direct* operates as an "automated exchange." Hence, the district court erred in deciding that issue in an *in limine* ruling that was the equivalent of a grant of summary judgment to CBOE. *See Lemelson*, 760 F.2d at 1260-61 ("[A]ny doubt as to the presence or absence of disputed issues of material fact must be resolved in favor of the presence of disputed issues * * *."). This Court should therefore reverse the judgment below and remand for trial.

III.   THE DISTRICT COURT IMPERMISSIBLY CONSTRUED THIS COURT'S CONSTRUCTION OF THE "AUTOMATED EXCHANGE" LIMITATION AND ALTERED ISE'S BURDEN OF PROOF

Construing patent claims is "a question of law, to be determined by the court." *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 384 (1996). This Court construed the term "automated exchange" to mean "a system for executing trades of

financial instruments that is fully computerized, such that it does not include

matching or allocating through the use of open-outcry" and remanded for further

proceedings based on that interpretation. *Chicago Bd.*, 677 F.3d at 1373, 1375. On

remand, it was for the jury to decide whether, as a matter of fact, the accused

product, CBOE*direct*, was such a system. *See PPG Indus. v. Guardian Indus.*

Corp., 156 F. 3d 1351, 1355 (Fed. Cir. 1998) ("[A]fter [a] court has defined the

claim with whatever specificity and precision is warranted by the language of the

claim and the evidence bearing on the proper construction, the task of determining

whether the construed claim reads on the accused product is for the finder of fact.").

    The district court had no power to further construe this Court's construction or

the question of fact defined by that construction. This Court chose specific words

for its construction of "automated exchange." Those words were "the law of the

case"; "sufficed to determine the question of infringement"; and "[we]re not

themselves limitations that require interpretation" by the district court. *E-Pass*, 473

F.3d at 1219-20, citing *Cal. Fed. Bank v. United States*, 395 F.3d 1263, 1274-75

(Fed. Cir. 2005) (citing law of the case doctrine); *see also Ins. Group Comm. v.*

Denver & R.G.W.R. Co., 329 U.S. 607, 612 (1947) (mandate rule requires that a

lower court "refuse to permit the relitigation of matters or issues previously

determined on a former review"); *In re Roberts*, 846 F.2d 1360, 1363 (Fed. Cir.

1988) (same); *Del Mar Avionics, Inc. v. Quinton Instrument Co.*, 836 F.2d 1320,

1324 (Fed. Cir. 1987) ("[P]rior findings and the claim construction based thereon are

the law of the case. They are not available for redetermination.").

Nevertheless, on remand, CBOE told the district court that it needed to resolve

"two significant issues" concerning the "automated exchange" limitation— *i.e.,*

whether the district court's construction of the term "automated" continued to

operate and the scope of the disavowal with respect to the term "automated

exchange." A10992, A10993-998[2:12-24]; A6369-71. CBOE then requested that

the district court *change* this Court's construction of "automated exchange" to

"incorporate[] the [district court's] construction of 'automated' * * * into the Federal

Circuit's construction of 'automated exchange'" and to "'reflect' the [district

court's] ruling on disavowal," notwithstanding that the disavowal was expressly

addressed by this Court and incorporated into its construction. A6387-89.

Adopting CBOE's position, the district court initially modified this Court's

construction of "automated exchange" to incorporate language from the very

construction that this Court reversed (emphasized portion below):

> An automated exchange is a system for executing trades of
> financial instruments that is fully computerized, such that
> it does not include matching or allocating through the use
> of open outcry.
>
> ***Conversely, a system for executing trades of financial
> instruments that permits automatic matching or
> allocating but also permits matching or allocating
> through oral communications between market***

29

> *professionals at a central location in open view of other*
> *market professionals is not an automated exchange*.

A6391 (emphasis added); *compare id. with Chicago Bd.*, 776 F. Supp. 2d at 611 *and*

A6301-02. ISE moved for reconsideration and, in response, the district court

modified some of the language from the "converse" construction but refused to

delete it entirely. A10350-51. The district court further stated that "another

instruction defining 'includes' may become advisable" because it still had not

"resolve[d] the question … of what th[is] [Court] meant by 'includes.'" *Id.*

As noted above, the district court subsequently ruled on remand that:

> The issue for trial is whether Hybrid is merely *two*
> *independent exchanges*, one an "automatic exchange"
> (CBOEdirect) and the other open outcry on the trading
> floor, or whether it is *an integrated system* that *requires*
> *interaction with the trading floor*. As such, ISE will have
> the burden to demonstrate (1) that each element (e.g.,
> interface, book memory means and processor means) of
> one or more claims is present in CBOEdirect, and (2) that
> *Hybrid's* "*rule-based order routing algorithm*" does not
> include matching or allocating through open outcry. This
> is necessary because the '707 patent disavows floor based
> trading.

A5 (emphasis added). The district court added the concepts of "integrated,"

"interaction" and "order routing" because "CBOE holds a patent * * * in which its

Hybrid trading system was distinguished over prior art (in relevant part) on the basis

of its 'unique rule-based order routing algorithm which integrates the features of

open-outcry trade execution with electronic order trade execution.'" A6 n.1.

30

In response to ISE's contention that the district court was not free to interpret this Court's construction of "automated exchange," which does not mention independent exchanges or integration with trading floors or order routing, the district court responded: "Well, I disagree." A11138-46[4:5-12:10].

Putting aside the issue addressed above—that, in ruling that ISE must prove that Hybrid "is fully computerized," the district court contradicted the sentences quoted immediately above and effectively granted CBOE summary judgment—the district court's interpretation of this Court's construction of the "automated exchange" limitation substantially changed the focus of the infringement inquiry regarding that claim limitation by adding concepts ("independent exchange," "integrated system," "interaction with the trading floor," and "order routing") untethered to the claim language and nowhere mentioned in this Court's construction or opinion. In light of this Court's construction, ISE has no burden to prove "independence" or to disprove "integration" or to address Hybrid's rule-based order routing algorithm or to mention Hybrid at all: rather, it must prove only that CBOE*direct* is "a system for executing trades of financial instruments that is fully computerized, such that it does not include matching or allocating through the use of open-outcry." *Chicago Bd.*, 677 F.3d at 1373. It may be that CBOE will make arguments about independence and integration and its routing algorithm in an attempt to rebut ISE's contention that CBOE*direct* is a fully computerized system

31

for executing trades, and that ISE will offer arguments in response, but the ultimate issue for trial is not whether CBOE*direct* is "independent" of or "integrated" with CBOE Hybrid, but instead whether it is "fully computerized [and] does not include matching or allocating through the use of open-outcry." *See id.*

Moreover, the district court improperly relied on CBOE's own patent to justify adding to the infringement inquiry whether CBOE practiced its patented "rule-based order routing algorithm." This Court's construction does not mention CBOE's patent or a "rule-based order routing algorithm," and it is antithetical to the law of infringement to place a burden of proof on ISE regarding CBOE's patent because "the existence of one's own patent does not constitute a defense to infringement of someone else's patent." *Bio-Technology Gen. Corp. v. Genentech, Inc.*, 80 F.3d 1553, 1559 (Fed. Cir. 1996); *Vaupel Textilmaschinen KG v. Meccanica Euro Italia S.P.A.*, 944 F.2d 870, 879 n. 4 (Fed. Cir. 1991).

In sum, the district court's decision to define the question of fact for the jury based on its own interpretation of this Court's construction of "automated exchange" was a violation of the mandate rule. This Court should remand with the instruction that it is ISE's burden to prove only that CBOE makes, uses, or sells an "automated exchange" or "a system for executing trades of financial instruments that is fully computerized, such that it does not include matching or allocating through the use of open-outcry."

32

IV.   THE DISTRICT COURT'S CONSTRUCTION OF "MATCHING" VIOLATED THIS COURT'S MANDATE AND IS INCONSISTENT WITH THE PATENT

The district court initially construed "matching" of incoming and previously received orders and quotations to be based on price only, holding that "matching" cannot be based on allocating parameters. *See Chicago Bd.*, 776 F. Supp. 2d at 614-15; A6309-10. This Court reversed, holding that "matching" is not based only on price because the '707 patent also discloses "matching" based on size, time, and pro rata considerations. *Chicago Bd.*, 677 F.3d at 1370-71 ("[T]he specification offers further support for ISE's contention. It provides [for] * * * match[ing] on a pro rata basis"; "'[t]ime priority' is another basis on which 'matching' can occur.").

CBOE argued that this Court's construction of "matching" "just do[es]n't work in the claims that are asserted" because this Court "did not analyze what happens when you take [its] construction and actually put it in a claim." A11488, A11507-509[293:10-29:4, 295:3-8]. At CBOE's urging, the district court construed this Court's construction of "matching" to require the completion of ***all*** steps in the "matching" process ***before*** any steps of the "allocating" process may begin.[4] A21-22. That construction results from the district court's continued misunderstanding that "matching" occurs based on price only:

---

[4] "Allocating" has been defined as "dividing all or portions of the incoming order among previously received orders and quotations." *Chicago Bd.*, 677 F.3d at 1369.

> The Federal Circuit, in holding that matching can be based on criteria other than price, seems to merge matching and allocating. As this court [(the district court)] previously understood the patent, matching for price was a threshold to allocating according to criteria such as *pro rata*, size or time priority. If matching based on price is equivalent to matching *pro rata*, then what is allocation? Does the Federal Circuit mean that orders and quotations could be traded according to time priority without price matching? With these limitations of understanding, this court has done its best to apply the Federal Circuit's construction of "matching."

A13 n.2.

The district court's understanding and its construction conflict with this Court's construction and was not permitted on remand. It is also inconsistent with the '707 patent.

A.   The District Court's Construction of "Matching" Conflicts with This Court's Construction

In construing this Court's construction of "matching," the district court ruled that all the "matching" steps with respect to a previously received order or quotation must be completed ***before*** any allocating steps with respect to the incoming order or quotation begin. A21-22; *see also* A13 n.2. That ruling violated this Court's mandate because it was inconsistent with this Court's construction. *See E-Pass*, 473 F.3d 1213 at 1220 ("The terms courts use to enunciate the proper construction of a claim are not themselves limitations that require interpretation.").

34

As noted on page 6-7, *supra*, the '707 patent discloses several steps to the matching process for each previously received order or quotation. A11591-597[377:18–381:3, 382:22-383:6]; *see also* A11550-571[336:14-357:10]; A147-48[14:50-15:31]. First, a previously received order or quotation is identified as one which is at the best price for an incoming order or quotation and is therefore ***eligible*** for matching based on an allocating parameter. A11594-95[380:17-381:3]; *see also* A145[9:29-45, 9:58-10:8]. Next, using an allocating parameter, the automated exchange identifies a specific portion of the incoming order or quotation for the particular previously received order or quotation. A11595-96[381:1-382:16]; *see also* A147-48[14:50-15:35]. Then the previously received order or quotation is actually matched based on the allocating parameter, and the "matching" process is complete.

This Court noted in its earlier decision that the '707 patent discloses matching based on size as required by Claim 35, which recites a step of "matching a remaining portion of the incoming order or quotation preferentially against professional orders or quotations with larger size based on the allocating parameter":

> As discussed above in reference to claim 35, orders and quotations may further be matched based on size: 'Professional #2 now has the *largest size* and *66% of the size* at the highest bid (20/30) and is *matched* for 14 contracts, leaving 7 contracts. * * *'

35

Chicago Bd., 677 F.3d at 1370 n.4 (quoting A150[19:1-4]). In the example cited,

the "matching" process with respect to Professional #2's previously received order is

completed when Professional #2 is matched with a portion (14 contracts) of the

incoming order. The ***allocation*** process (or the dividing of the incoming order) must

start before the matching process is complete because the allocating process is what

determines that Professional #2 is entitled to 14 contracts. The allocating process

thereafter continues to divide any remaining portions among the remaining

professional orders or quotations—in this example, the 7 contracts that remain.

A150[19:1-4].

Further, this Court noted that claim 36, which requires a step of the

"matching" process to comprise "allocating," is ***consistent*** with its ruling that

"matching" and "allocating" are distinct. *Chicago Bd.*, 677 F.3d at 1370-71 n. 6.

Under the district court's interpretation of this Court's construction, however,

"matching based on an allocating parameter" can never comprise "allocating"

because all matching steps must be complete before any allocating steps may begin.

See A21-22; A13 n.2.

Simply put, "allocating" and "matching" are distinct and different processes

that are not co-extensive in time. However, to match a previously received order to

an incoming order or quotation based on an allocating parameter, a divided portion

of the incoming order or quotation must first be determined. This Court's

36

construction requires "matching" and "allocating" to be distinct but does not require completion of all steps of the matching process before the allocating process may begin. Hence the district court erred by reading such a requirement into this Court's construction.

B.   The District Court's Construction of "Matching" Is Inconsistent With The '707 Patent

As noted, before the final step of the matching process described above is complete, the automated exchange begins the allocation process to determine how to divide portions of the incoming order or quotation among the previously received orders and quotations. The allocation process continues until the incoming order has been divided among each of the previously received orders or quotations, or there is no portion of the incoming order remaining. The "matching" and "allocating" processes neither start nor end at the same point in time but rather occur at distinct points in time.

The flow chart depicted in Figures 4(a) and 4(b), which "illustrates an embodiment of bid matching according to the invention" (A148[15:32-33]), shows that, although "matching" and "allocating" are distinct processes, they are not unrelated.

37
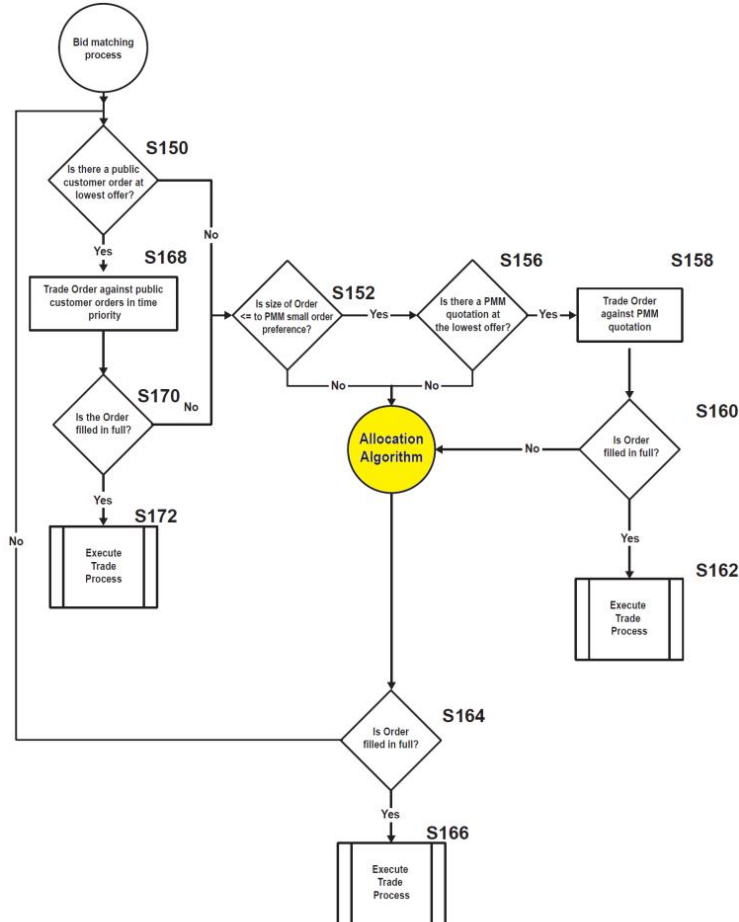
FIG. 4(a)
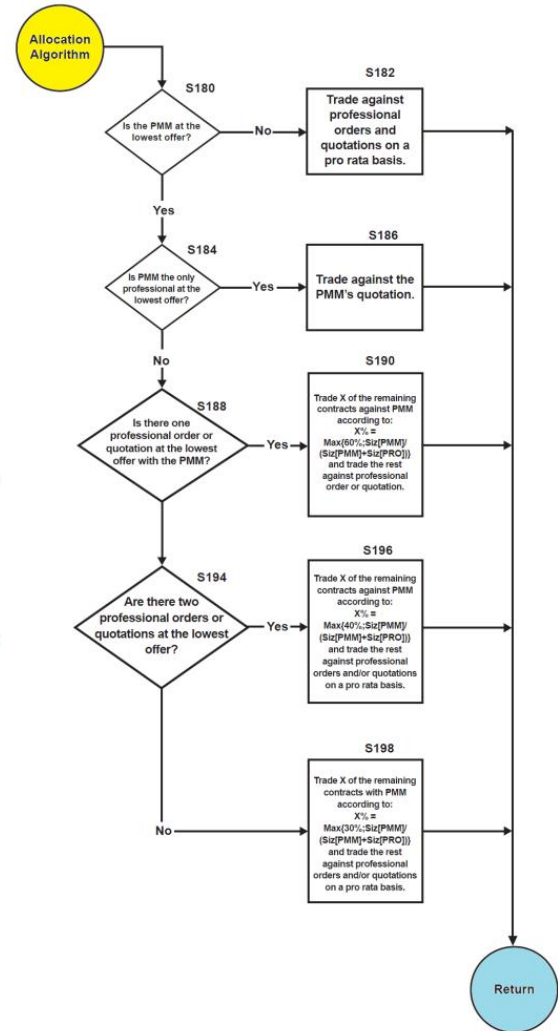
FIG. 4(b)

A124-25. The middle of Figure 4(a) is a circle representing an "Allocation Algorithm" (shaded yellow), which is a continuation of the flow chart of the bid matching process depicted in Figure 4(b). When the steps in Figures 4(b) have been completed, the process "[r]eturn[s]" to Figure 4(a) (shaded blue). At this point, each of the previously received orders that were matched with a portion of the incoming order are sent to the execute trade process. A124[S172, S166]; A148[16:64-66]; A149[17:20-24]. These individual "matches" (the result of "matching * * * based

on the allocating parameter" recited in claim 35, *see* A158[35:40-47]) include the identity of the counterpart previously received orders or quotations for the incoming order and the amount of the incoming order allocated to it based on the allocating parameter. *See* A148[16:59-66]; A149[17:4-24]; 149-50[18:61-19:7] ("PRO #2 * * * is *matched* 14 contracts * * *.") (emphasis added).

As this Court recognized, when an incoming order or quotation is matched based on an allocation parameter—such as size in claim 35, time priority in S168 of Fig. 4(a) or "pro rata" in claim 2—to a previously received order or quotation, that match must occur *after* the amount of the incoming order that the previously received order or quotation will receive has been determined, *i.e.,* after the allocation process has begun.

V.   THE DISTRICT COURT ERRED IN HOLDING THE "MEANS FOR MATCHING" OF CLAIM 2 INDEFINITE

Claim 2 depends from claim 1 and recites "[t]he exchange according to claim 1, wherein processor means further comprises means for matching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis." A155[30:15-18]. The parties and the district court agreed that the function of the "means for matching" of claim 2 is "[m]atching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis." A31. However, the district court erroneously determined that claim 2 was indefinite for lack of corresponding structure because the district court believed

that all matching steps must be complete before any allocating steps may begin. A31, A39-40; A9-11; A21-22. That was error, as shown above, and it infected the district court's consideration of the structure issue because the court wrongly concluded that the structure set out in the specification for the matching process applied only to the allocating process. A21-22.

Whether a patent discloses a corresponding structure for a computer-implemented means-plus-function limitation, such as the "means for matching" of claim 2, depends on (1) whether the specification discloses any structure at all and (2) whether the specification discloses and describes an algorithm with sufficient detail to define the structure and make the bounds of the claim understandable to one of ordinary skill in the art. *See Noah Sys., Inc. v. Intuit Inc.*, 675 F.3d 1302, 1312-13 (Fed. Cir. 2012). The '707 patent meets both requirements.

A. The '707 Patent Discloses Structure For Performing The Recited Function Of Claim 2

In reversing the district court's construction of "matching" as based solely on price, this Court recognized that the '707 patent discloses matching "on a pro rata basis" as recited in claim 2. *Chicago Bd.*, 677 F.3d at 1370. As the Court explained, referring to an example in the patent that supposes 21 contracts in an incoming order and the matching of those contracts:

> As discussed above in reference to claim 35, orders and quotations may further be matched based on size: 'Professional #2 now has the *largest size* and *66% of the*

40

> *size* at the highest bid (20/30) and is *matched* for 14
> contracts, leaving 7 contracts. * * *'

Chicago Bd., 677 F.3d at 1370 n.4 (quoting A150[19:1-4]). In the cited example,

Professional #2 "is matched for 14 contracts" because Professional #2's pro rata

share of the incoming order is 66% or 20/30. That provision in the specification is

sufficient to establish a structure for the means of matching.

The district court erroneously held that the passage quoted above discloses a

"means for ***allocating***" on a pro rata basis and not "matching" on a pro rata basis.

A21-22 (emphasis added). Citing that very passage in rejecting the district court's

earlier construction of "matching," this Court understood that the passage refers to

"matching" and the district court's contrary view must be rejected.

B.   The '707 Patent Discloses An Algorithm For Performing The Recited Function Of Claim 2

ISE's expert, Dr. Ma, opined that one of ordinary skill in the art would

understand the passage identified by this Court as well as other provisions in the

'707 patent as disclosing an algorithm for performing the recited function of the

"means for matching" limitation of claim 2. A11547-598[333:14-384:7]; A9444-

46[¶¶219-27]. Such expert testimony is appropriate evidence on the issue of

whether a patent specification adequately discloses an algorithm as corresponding

structure for a means-plus-function limitation. *See Noah Sys.*, 675 F.3d at 1313

(proper inquiry is whether patent disclosure is sufficient "in light of what one of

41

ordinary skill in the art would understand the disclosure to impart"). Dr. Ma's opinions regarding what one of ordinary skill in the art would understand from the disclosure of the '707 patent were essentially unrebutted by CBOE's expert, Dr. Steil.

The '707 patent expressly discloses a formula for calculating a professional's pro rata share of a portion of an incoming order or quotation: $\frac{Siz[PMM]}{(Siz[PMM]+Siz[PRO])}$.[5] A9724, A9780[¶ 292]; A11564-68[350:13-354:1] (ISE expert Dr. Ma explaining that the formula in Equation #1 in the '707 patent is a formula for calculating pro rata); A9571, A9592[206:9–18](CBOE's expert Dr. Steil agreeing that a pro rata formula is disclosed in the '707 patent); A9593[211:7–213:7] (Dr. Steil agreeing that the "this formula seems to be an illustration of how one might achieve in the end a pro rata allocation"); A9397, A9445-46[¶¶224–26]. By substituting Siz[(particular professional)] for Siz[PMM], that same formula can be used to determine other professionals' pro rata shares as well. The particular portion of the specification identified by this Court as "matching based on size" discloses the use of precisely such a substitution: "[Professional] #2 now has the largest size and 66% of the size at the highest bid (20/30) and is matched for 14 contracts." *Chicago Bd.*, 677 F.3d at 1370 n.4.

---

[5] "SIZ" refers to the size of the incoming order; "PMM" refers to a Primary Market Maker; and "PRO" refers to a Professional.

42

Further, the '707 patent specification expressly discloses at column 18, line

10, to column 19, line 4, a four-step algorithm for "matching the remaining portion

with professional orders or quotations in the book memory means on a pro rata

basis" in relation to the steps of the offer *matching* process 36 and Table III in the

patent (depicted below). A9446[¶225].

TABLE III

BID						
CUS	PRO #1	PRO #2	PRO #3	PMM	TOTAL	PRICE
3	20	20	10	10	63	3
10	20				30	2½

A149. This example assumes an incoming public customer order to sell 49 contracts

at price 3. After 3 of 49 contracts are matched to the previously received public

customer (CUS) at price 3, "[t]he offer matching process" applies the allocation

algorithm in Figure 5(b) to determine the matches for any professional orders or

quotations at the best price. A149[18:25-42].

First, the offer matching process identifies those previously received

professional orders eligible to receive a portion of the incoming order, *i.e.,* those at

the best price. Because a primary market maker (PMM) and three professionals

(PRO #1, PRO #2 and PRO #3) are at the best price, the offer matching process first

determines how much of the incoming order will be matched to PMM using the

43

allocation formula in S238, in this case matching PMM with 10 contracts. A149[18:36-42].

"The balance of 36 contracts are allocated among the three professionals on a pro rata basis." A149[18:61-63]. As explained by ISE's expert, for each of the three professionals, the patent teaches that the expression $\frac{Siz[professional\ order]}{(Siz[professional\ order]+Siz[PRO])}$ —where "Siz[professional order]" is the size of a particular professional order (e.g., PRO# 1), and "Siz[PRO]" is the sum of the sizes of all the other professional orders at the best price—determines the professional's pro rata portion. *See* A149[18:49-52].

Second, using that formula, the offer matching process determines that PRO#1 is entitled to be matched to 40% or (20/50) of the orders among the professionals PRO#1, PRO# 2 and PRO# 3. PRO#2 has 66% (20/30) of the orders between PRO# 2 and PRO #3. *See* A149-50[18:63-19:4].

Third, based on those percentages, the offer matching process determines the number of contracts that should be allocated to each professional:

> In this case, PRO #1 has 40% of the orders among the professionals (20/50) and is entitled to 15 contracts, leaving 21 contracts. PRO #2 has now has the largest size and 66% of the size at the highest bid (20/30) and is matched for 14 contracts, leaving 7 contracts. PRO #3, the last remaining professional, trades the balance of 7 contracts.

A149-50[18:63-19:4].

Fourth, after each pro rata allocation is determined and "the order has been completely filled, [the automated exchange] * * * *sends the matches* [in this case the three individual matches] to the execute trade process 27." A148[16:26-67] (emphasis added); A149[17:1-23] ("In step S212 of FIG. 5(a), the offer matching process 35 determines the entire order was matched and *sends the matches* to the execute trade process 27 at step [S]214.") (emphasis added).

Dr. Ma opined that one of ordinary skill in the art would recognize that the above disclosure teaches an algorithm for matching a portion of an incoming order or quotation among professionals on a pro rata basis as recited in claim 2. *See* A9445-46[¶¶224–26]; A9777-81[¶¶283–93]. The '707 patent discloses other examples where the same algorithm is used to match on a pro rata basis the remaining portion of an incoming order or quotation with professional orders or quotations. *See* A149[18:1-8] ("PRO #2 has 20 out of the 30 contracts of the orders placed by the two professionals at the lowest offer and is entitled to 66% of the 6 remaining contracts, or 4 contracts."); A149-50[18:63-19:4]; A148[16:59-66]; A11550-572[333:14-358:15] (Dr. Ma explaining that the second example in the '707 patent at A148[16:12-66] discloses an algorithm for performing the recited function of the "means for matching" of claim 2). Importantly, Dr. Ma also testified that,

45

given the examples disclosed in the '707 patent, one of ordinary skill in the art[6] at the time of the invention "would [have been] able to [program the disclosed] algorithm on a computer." *See* A11572[358:17-23].

Accordingly, because these textual descriptions from the '707 patent are sufficient disclosure of an algorithm for one of ordinary skill in the art to satisfy the corresponding structure required for the "means for matching" of claim 2, claim 2 is not invalid as indefinite. *See Typhoon Touch Techs., Inc. v. Dell, Inc.*, 659 F.3d 1376, 1384-86 (Fed. Cir. 2011) (reversing summary judgment that means-plus-function limitation was indefinite and ruling that the textual description in the specification of the steps the computer had to perform sufficiently disclosed the algorithm where there was "no evidence that a programmer of ordinary skill would not be able to program the algorithm" based on that textual description).

It follows that the district court's judgment that claim 2 is invalid as indefinite should be reversed.

---

[6] Dr. Ma opined that one of ordinary skill in the art of the field of invention disclosed in the '707 patent is "[1] a person in the field of computer science—in particular computer or software programming—with a bachelor's degree in computer science, or * * * [2] a person in the field of screen-based securities trading platforms with a bachelor's degree in business or economics[] or equivalent and some practical experience in the field of computer science, such as 3-5 years of computer programming experience." A9398-99[¶¶ 50-51].

VI.   THE DISTRICT COURT ERRED IN CONSTRUING THE PREFERENTIALLY LIMITATION

Claim 1 of the '707 patent recites "allocating a remaining portion of the incoming order or quotation preferentially against professional orders and quotations with larger size" (the "preferentially limitation").[7] A155[30:11-15]. ISE and CBOE's proposed constructions were similar:

ISE	CBOE
Allocating a remaining portion of the incoming order or quotation in a preferred manner against professional orders and quotations that are larger in size than other professions [sic] orders and quotations in the books memory means.	Allocating larger portions of the remaining incoming order or quotation to professionals quoting or ordering larger size

A2103; A2381; A29; *see also* A1907, A1923-24; A2338, A2348; A2056, A2088-89; A2198, A2231-32. Both constructions were consistent with the intrinsic evidence and recognized that the limitation means that ***larger portions*** of an incoming order or quotation are divided among previously received professional orders and quotations having larger size, not that a larger professional order or quotation is completely satisfied before the next largest orders or quotations may be satisfied.

At the claim construction hearing, the parties agreed that there was no substantive dispute concerning their respective proposed constructions because both

---

[7] Claim 35 recites a similar limitation: "second matching a remaining portion of the incoming order or quotation preferentially against professional orders and quotations with larger size based on the allocating parameter." A158[35:44-47].

made it clear that previously received professional orders and quotations received

larger *amounts* of an incoming order or quotation if those professional orders and

quotations were for larger sizes. A10698-703[154:13-17, 157:24-158:5] (CBOE

counsel recognizing that the preferentially limitation "go[es] to the issue of the

amount of the order that's allocated to the professional" and that the parties are not

"saying anything different"); *see also* A10701[156:11-12] (CBOE counsel stating

that "the guy who quotes the most, gets the most."). That agreement was largely

based on the applicant's statement in the prosecution history explaining (in reference

to claim 1) that a purpose of the invention was to provide incentives to professionals

to trade larger sizes by "basing *the amount* of the allocation [to professionals] on the

size of the orders and quotations." A729, A844, A862 (emphasis added).

The district court's initial construction of the preferentially limitation—

"[a]llocating a remaining portion of the incoming order or quotation according to the

size of the order or quotation, from largest to smallest" (A29)—was not proposed by

either party. Days before trial was to begin, the district court explained that the

phrase "from largest to smallest" required "a sequential filling of orders" from

largest to smallest (A20; A24)—meaning that the largest previously received

professional order first receives *the entire amount* of its order before the next largest

order based on size is filled, up to the entire amount of its size, etc. until the

incoming order is completely divided. *See* A20.

48

As shown below, requiring a "sequential filling of orders" from largest to smallest makes the claims internally inconsistent, contradicts the specification, and excludes all disclosed embodiments. *See Lava Trading, Inc. v. Sonic Trading Management, LLC*, 445 F.3d 1348, 1354-55 (Fed. Cir. 2006) (rejecting construction adopted by district court that "conflicts with the plain meaning of claim [] and excludes embodiments disclosed in the specification").

ISE submits that the preferentially limitation should be construed as "allocating larger portions of an incoming order or quotation to professionals quoting or ordering larger size as compared to those professionals quoting or ordering smaller sizes."

A.   The District Court's Construction Is Inconsistent With The Plain Claim Language

By requiring "a sequential filling of orders" or quotations from "largest to smallest" (A20; A24), the district court violated a fundamental tenet of claim construction—adopting a construction that renders the '707 patent claims illogical and internally inconsistent.

Claim 1 describes a system for executing trades that includes parameters for "allocating a remaining portion of the incoming order or quotation preferentially against professional orders and quotations with larger size." A155[30:11-15]. Under the plain language of the claim, the term "preferentially" refers to the ***amount*** of an incoming order or quotation that is allocated to a previously received

49

professional order or quotation because "allocating" has been construed to mean "dividing all or portions of the incoming order or quotation among previously received orders and quotations." *See Chicago Bd.*, 677 F.3d at 1369.

Dependent claim 2 requires that the automated exchange recited in claim 1 "match[es] *the remaining portion* with professional orders and quotations * * * on a pro rata basis." A155[30:15-18]. Contrary to a sequential filling from largest to smallest—where a single previously received order, if it is large enough, may exhaust an entire incoming order—a pro rata allocation allots a *portion* of the incoming order or quotation to *each* previously received order or in proportion to their size. Because claim 2 (which depends from claim 1) requires a pro rata allocation parameter, the scope of claim 1 must be broad enough to include a pro rata allocation parameter. *Acumed LLC v. Stryker Corp.*, 483 F.3d 800, 806 (Fed. Cir. 2007)("[I]ndependent claims are presumed to have broader scope than their dependents * * *.").

The district court's construction also contradicts the language of dependent claim 3. Claim 3 includes a means-plus-function limitation directed to "matching *the remaining portion* based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker." A155[30:19-25]. The district court and both parties agreed that Figure 4(b), which is entitled "Allocation Algorithm" in the disclosed matching

process, discloses an algorithm for allocating "the remaining portion." A32-33;

A2383-84. Figure 4(b) shows that the primary market maker's quotation ***always***

receives the first allocation—a sequence solely based on its identity as a primary

market maker—***even if*** its quotation is for a smaller size than other professionals'

orders and quotations. A125. Thus, the district court's construction of the

preferentially limitation contradicts its own construction of claim 3 and renders the

claim nonsensical.

Because construing the preferentially limitation in claim 1 to require a

sequential filling of orders from largest to smallest "is illogical and does not accord

with the plain import of" dependent claims 2 and 3, the district court's construction

should be rejected. *See Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d

1323, 1336 (Fed. Cir. 2001).

B.   The District Court's Construction Is Inconsistent With The Specification

Each disclosed embodiment of the trade matching process shows that the

preferentially limitation concerns the amount being allocated to professionals. In

contrast, a "sequential filling of orders" from largest to smallest does not appear in

the specification.

In its earlier opinion, this Court referenced claim 35, which requires

"matching a remaining portion of the incoming order or quotation ***preferentially***

against professional orders and quotations with larger size based on the allocating

51

parameter" (emphasis added) and recognized that the specification discloses an

embodiment of "matching * * * based on size":

> As discussed above in reference to claim 35, orders
> and quotations may further be **matched based on size**:
> "Professional # 2 now has *the largest size* and *66% of the
> size* at the highest bid (20/30) and is *matched* for 14
> contracts, leaving 7 contracts. Professional # 3, the last
> remaining professional, trades the balance of 7 contracts."

Chicago Bd., 677 F.3d at 1370 n. 4 (quoting A150[19:1-4]) (emphasis added; italics

in original). This passage shows that the amount determined for a particular

previously received order (here Professional # 2), *i.e.,* the allocation, is based on the

size of the previously received order.

The district court's construction also reads out other disclosed embodiments

of the invention. Table II in the specification shows an example of existing bids

from a public customer, two professionals, and a primary market maker.

TABLE II

OFFER					
Price	Total	CUS	PRO #1	PRO #2	PMM
2½	50		10	20	20
2¼	30	10	10		10

A149[17:25-33]. The specification then uses the bid matching process described in

Figures 4(a) and 4(b) to show how those bids are matched with an incoming

customer limit order to buy 10 contracts at 2½. A149[17:36-18:8].

The bid matching process of Figure 4(a) first determines the absence of any

public customer orders at the lowest offer (S150)—here, a price of "2½."—and that

the size of the incoming order (10 contracts) is not less than or equal to the PMM

small order preference (S152). A124; A149[17:6-10]. The matching process then

turns to the "Allocation Algorithm" depicted in Figure 4(b) to allocate the incoming

order among the existing professional orders and quotations as required of the

"remaining portion" of claim 1. A124; A149[17:41-47]. The Allocation Algorithm

determines that the PMM is at the lowest offer (S180). A125. Because Table II

shows that two other professionals (PRO #1 and PRO #2) besides PMM are at the

lowest offer (S184), the algorithm moves to step S196 (A125) and allocates the

remaining portion of the incoming order among PMM, PRO #1, and PRO #2 as

depicted in Figure 4(b):
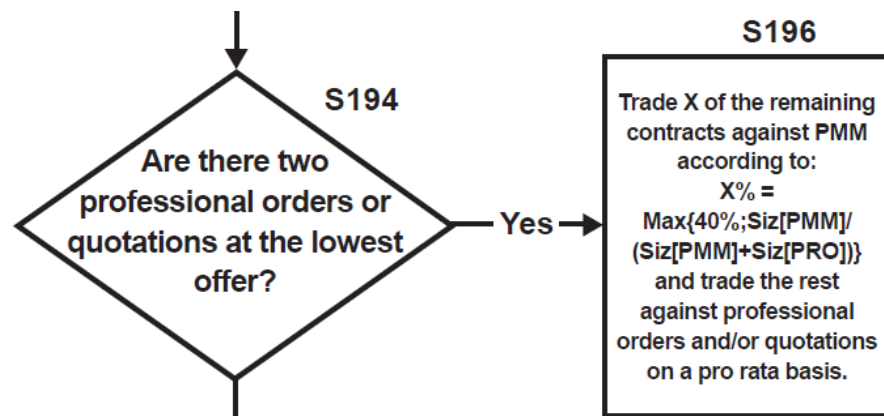
In S196, which the specification calls "Equation #2," the variable "siz [pmm]

is the size of the offer of the PMM at the market price; and siz [pro] is the size of the

combined orders of the two professionals." A149[17:50-59]. In the example, the

PMM always goes first regardless of the size of its order or quotation. Then a pro rata formula is used to allocate the remaining portion. Thus, the amount of an incoming order allocated to a particular professional always depends on the size of that professional's order or quotation.

When applied to the example in Table II, the result of Equation #2 is that the PMM "is entitled [to] sell 40% of the 10 contracts against the incoming order, or 4 contracts." A149[17:66-18:1]. The specification states that PRO #2's share was "computed first," which is the only intrinsic support CBOE has identified as allegedly requiring a sequential filling of orders from largest to smallest. *See* A11432-434[218:23-220:3]. However, computation of shares is not the filling of an order. Nothing in S196 in Figure 4(b) requires or even suggests filling the entirety of a professional order in a particular sequence before moving on to the next professional order or quotation. Rather, the example clearly shows that the ***amount*** allocated to each professional is dependent on the size of their respective orders.

Indeed, the sequence in which the professionals' allocations or shares is computed does not matter—the resulting math (or allocation) would be the same regardless of whose allocation is computed first. Calculating PRO #1's allocation first would start by finding that PRO #1 had 10 out of the existing 30 contracts of the orders placed by the two professionals at the lowest offer. Hence, 33% or 2 of the 6 remaining contracts are allocated to PRO #1, and PRO #2 is allocated 4 contracts.

Thus, regardless of the order in which the professionals' allocations are calculated, PRO #2 still receives a larger portion of the incoming order than PRO #1 because PRO #2's offer was for a larger size.

Under the district court's construction requiring "a sequential filling of orders" from largest to smallest, after PMM traded, the exchange would attempt to fill PRO # 2's order. Because PRO #2's order is for 10 contracts and there are only 6 remaining contracts in the incoming order, PRO #2 would receive *all* of those 6 remaining contracts, instead of just 4 contracts as disclosed in the specification. PRO #1 would receive nothing. Thus, the district court's construction requiring "a sequential filling of orders" from largest to smallest would improperly exclude this disclosed embodiment of the invention. *See Lava Trading*, 445 F.3d at 1354-55 (rejecting district court's construction that "excludes embodiments disclosed in the specification"); *Oatey Co. v. IPS Corp.*, 514 F.3d 1271, 1277 (Fed. Cir. 2008) (rejecting claim construction that excluded embodiment disclosed in a figure of the patent).

C.   The District Court's Construction Is Inconsistent With The Prosecution History

The applicant explained during prosecution that the purpose of its invention was to provide deep and liquid markets by giving professionals an incentive to professionals to trade larger sizes by "***basing the amount of the allocation*** [to professionals] on the size of the orders and quotations." A862 (emphasis added).

The applicant's discussion of the preferentially limitation shows that the limitation refers to the "portion" of the incoming order or quotation being allocated, and not the sequence in which the allocation occurs:

> According to one embodiment, the allocating parameters include parameters for "allocating a remaining portion of an incoming order or quotation preferentially against professional orders and quotations with larger size." *See* claims 1 and 35. By ***allocating larger portions of the incoming order against professionals quoting larger size***, the exchange according to the present invention gives an incentive to professionals to quote a deeper and more liquid market.

A861 (emphasis added).

That discussion of the allocation of a "portion" of an incoming order to larger existing professional orders is consistent with the specification and further confirms that the district court erred in construing the "preferentially" limitation to require existing orders to be filled entirely in sequence from largest to smallest.

D.   The District Court's Erroneous Construction Is Based On A Misapplication Of The Doctrine Of Claim Differentiation

The district court rationalized its construction by stating that if the preferentially limitation "were interpreted as merely allocating proportionally according to size, *i.e.*, *pro rata*, [claim 1] would not be distinct from claim 2."[8] A20. The district court thought that its construction was supported by the doctrine of

---

[8] Neither party proposed construing the "preferentially" limitation as "allocating proportionally according to size."

claim differentiation, quoting this Court's statement in *Phillips* that the "presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim." A24 n.1 (quoting *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005)).

The district court misunderstood the doctrine. A limitation from a dependent claim may not be "present" in the independent claim, but that does not mean that the independent claim ***excludes*** the limitation. On the contrary, it means that the independent claim must be broad enough to encompass inventions with the limitation from the dependent claim ***and also*** more broadly encompass inventions without that limitation. *Acumed*, 483 F.3d at 806 ("[I]ndependent claims are presumed to have broader scope than their dependents…").

Accordingly, the doctrine of claim differentiation does not support the district court's construction of the "preferentially" limitation.

VII.   THE DISTRICT COURT ERRED IN LIMITING THE QUERYING STEP OF CLAIM 56 TO A LIMITATION IN DEPENDENT CLAIM 58

Claim 56 contains a limitation that is directed to "***querying*** an away market to determine an away market price." A160[39:21-22] (emphasis added). Claim 58 depends from claim 56 and recites "the ***step of querying*** [in claim 56] further ***comprises*** receiving market price information from a reporting entity." A160[39:38-40] (emphasis added). ISE contends that CBOE performs the step of querying an

away market of claim 56 through its receipt of "market price information from a reporting entity." A12279-81, A12284-85; *see also* A9397, A9485-87[¶¶397-401].

CBOE argued below that, under the doctrine of claim differentiation, "querying * * * is something entirely different from 'receiving' an away market price from a 'reporting entity.'" A12182-85. The district court agreed and precluded ISE from relying on CBOE's use of "price information from a reporting entity" to establish that CBOE performs the step of querying an away market required by claim 56. A23.

Independent claims must at least be broad enough to encompass limitations from their dependent claims. *See Acumed*, 483 F.3d at 806. The use of price information from a reporting entity is specifically recited in dependent claim 58 as part of the "querying step." According to the express language of the claims, ISE should not be precluded from relying on CBOE's receipt of price information to show that CBOE satisfies the "querying" step of independent claim 56. *See Research Plastics, Inc. v. Federal Packaging Corp.*, 421 F.3d 1290, 1295 (Fed. Cir. 2005) ("[C]laim terms are presumed to be used consistently throughout the patent, such that the usage of a term in one claim can often illuminate the meaning of the same term in other claims."). The district court fundamentally misunderstood "claim differentiation" in deciding that ISE may not rely on price information reported by a reporting entity to establish infringement of claim 56.

Consistent with the language of claims 56 and 58, the specification discloses that querying of an away market may be performed through the use of price information received from a reporting entity: The specification states that "the order process 25 *checks the price on the away market 17 as reported by the reporting entity 19 to determine if there is a better price available*," thus determining the away market price. 145[9:39-42] (emphasis added). The specification discloses that "[t]he reporting entity 10 may be, for example, the Options Price Reporting Authority (OPRA), which collects price and size data for all options traded on exchanges in the United States and provides *this data to subscribers*," such as ISE and CBOE. A144[7:54-60].

In short, the district court's ruling that the querying step of claim 56 cannot include receiving price information from a reporting entity, such as OPRA (A23), contradicts the express language of claim 58 and the teachings of the '707 patent and should be rejected. *See NTP, Inc. v. Research In Motion, Ltd.*, 418 F.3d 1282, 1297 (Fed. Cir. 2005) (rejecting construction that "contradicts the text and figures of the written description); *Phillips*, 415 F.3d at 1315 ("[T]he specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'"), quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996).

VIII. THIS COURT SHOULD REASSIGN THE CASE TO A DIFFERENT JUDGE ON REMAND

In this case from the Northern District of Illinois, Seventh Circuit law governs reassignment on remand. *See Trimed, Inc. v. Stryker Corp.*, 608 F.3d 1333, 1343-44 (Fed. Cir. 2010); *Eolas Techs., Inc. v. Microsoft Corp.*, 457 F.3d 1279, 1280, 1283 (Fed. Cir. 2006) (applying Seventh Circuit law and reversing denial of motion for reassignment; stating "Rule 36 applies to remands from [the Federal Circuit] as well as from the Seventh Circuit itself."). Seventh Circuit Rule 36 provides:

> Whenever a case tried in a district court is remanded by this court for a new trial, it shall be reassigned by the district court for trial before a judge other than the judge who heard the prior trial unless the remand order directs or all parties request that the same judge retry the case. In appeals which are not subject to this rule by its terms, this court may nevertheless direct in its opinion or order that this rule shall apply on remand.

This Court has recognized that Rule 36 "makes reassignment the norm" in the Seventh Circuit. *Eolas*, 457 F.3d at 1283. "The purpose of Rule 36 is to avoid, on retrial after reversal, *any* bias or mindset the judge *may* have developed" in adjudicating the underlying proceedings. *Id*. (quoting *Cange v. Stotler and Co*., 913 F.2d 1204 (7th Cir. 1990) (emphasis added by this Court). Although Rule 36 "does not automatically apply where the judgment reversed has not resulted from a trial, [courts] apply it in [their] discretion to avoid the operation of bias or mindset which seems likely to have developed from consideration and decision of motions to

dismiss or motions for summary judgment and the like." *Cange*, 913 F.2d at 1208. The Rule thus gives appellate courts the "free[dom] to permit the default rule [of reassignment] to operate or to permit remand to the same judge or to require reassignment when the default rule would not otherwise operate." *Eolas*, 457 F.3d at 1283 (*citing Cange*, 913 F.2d at 1208).

The Seventh Circuit has frequently invoked its discretion to order reassignment upon reversal of dispositive rulings prior to trial. *See*, *e.g.*, *Holmes v. Vill. of Hoffman Estate*, 511 F.3d 673, 688 (7th Cir. 2007) ("Because the district court, in granting summary judgment in favor of the defendants, improperly resolved a number of factual disputes in the defendants' favor, Circuit Rule 36 shall apply on remand."); *AHP Subsidiary Holding Co. v. Stuart Hale Co.*, 1 F.3d 611, 620 (7th Cir. 1993) (exercising discretion to apply Rule 36 to reversal of summary judgment).

The district court judge in this case made fundamental errors of law and fact—many of which flow from her entrenched opinion that ISE could prevail only by proving infringement of a product other than the product that ISE actually accused. In addition to *sua sponte* redefining the accused product, the district court adopted claim constructions that were advocated by neither party and inconsistent with the intrinsic evidence of the patent. The district court also disregarded this Court's opinion from ISE's first appeal. In these circumstances, this Court should

exercise its discretion and order reassignment, consistent with the default rule of the

Seventh Circuit.[9] *Eolas*, 457 F.3d at 1283; *Cange*, 913 F.2d at 1208.

CONCLUSION

The judgment of the district court should be reversed and the case should be

remanded and reassigned to a different district court judge.

---

[9] This Court has granted reassignment even when applying stricter standards. *See Trimed*, 608 F.3d at 1344 (reversing district court judge for a second time and ordering reassignment under Ninth Circuit law); *Research Corp. Techs., Inc. v. Microsoft Corp.*, 536 F.3d 1247, 1255 (Fed. Cir. 2008) (finding that "the strongly expressed convictions of the trial court in this case may not be easily and objectively reconsidered" and ordering reassignment under Ninth Circuit law).

Date: July 1, 2013   Respectfully submitted,

/s/Parker H. Bagley
Parker H. Bagley
Michael S. DeVincenzo
Calvin E. Wingfield
GOODWIN PROCTER LLP
The New York Times Building
620 Eighth Avenue
New York, NY 10018-1405
Tel: (212) 813-8800

Douglas J. Kline
GOODWIN PROCTER LLP
Exchange Place
53 State Street
Boston, MA 02109-2802
Tel: (617) 570-1000

Laurel A. Kilgour
GOODWIN PROCTER LLP
3 Embarcadero Center, 24th Floor
San Francisco, CA 94111
Tel.: (415) 733-6000

*Counsel for Appellant International
Securities Exchange, LLC*

ADDENDUM

Case: 13-1326   Document: 23   Page: 75   Filed: 07/01/2013

Case: 1:07-cv-00623 Document #: 723 Filed: 04/10/13 Page 1 of 2 PageID #:20954
AO 450(Rev: 5/85)Judgment in a Civil Case

United States District Court
Northern District of Illinois
Eastern Division

Chicago Board Options Exchange, Incorporated	**JUDGMENT IN A CIVIL CASE**
v.	Case Number: 07 C 623
International Securities Exchange, LLC	

☐   Jury Verdict. This action came before the Court for a trial by jury. The issues have been tried and the jury rendered its verdict.

☐   Decision by Court. This action came to trial or hearing before the Court. The issues have been tried or heard and a decision has been rendered.

IT IS HEREBY ORDERED AND ADJUDGED that FINAL JUDGMENT with respect to International Securities Exchange, LLC's ("ISE's") claim of infringement of U.S. Patent No. 6,618,707 ("the '707 patent") against Chicago Board Options Exchange, Incorporated ("CBOE") is ENTERED against ISE and in favor of CBOE, and ISE shall take nothing on its claim of infringement of the '707 patent against CBOE. FINAL JUDGMENT on CBOE's claim for declaratory judgment of non-infringement is GRANTED in favor of CBOE and against ISE. FINAL JUDGMENT on CBOE's claim for declaratory judgment of invalidity on claims 2, 4, 5 is GRANTED for indefiniteness under 35 U.S.C. § 112. CBOE's remaining declaratory judgment claims of invalidity against ISE are DISMISSED WITHOUT PREJUDICE, without waiving CBOE's right to reassert the claims in this action if the appellate court remands the case to the District Court or refuses to hear the merits of the appeal. CBOE does not infringe claims 1-6, 9, 10, 35-36, 43, 45, and 56 of the '707 patent. Claims 2, 4, and 5 of the '707 patent are invalid as indefinite under 35 U.S.C. § 112. Costs are awarded to CBOE, the prevailing party.

Thomas G. Bruton, Clerk of Court

Date: 4/10/2013   _____

                                        /s/ Michael Dooley, Deputy Clerk

A1

A2

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

CHICAGO BOARD OPTIONS EXCHANGE, INCORPORATED, Plaintiff, vs. INTERNATIONAL SECURITIES EXCHANGE, LLC, Defendant.	Case No. 07 CV 0623 Judge Joan Humphrey Lefkow

FINAL JUDGMENT

In accordance with the parties' March 22, 2013 Stipulation (Dkt # 720), good cause

having been shown, and there being no just cause for delay, the Court hereby enters Final

Judgment in this matter as follows:

1. FINAL JUDGMENT with respect to International Securities Exchange,

LLC's ("ISE's") claim of infringement of U.S. Patent No. 6,618,707 ("the '707 patent")

against Chicago Board Options Exchange, Incorporated ("CBOE") is ENTERED against

ISE and in favor of CBOE, and ISE shall take nothing on its claim of infringement of the

'707 patent against CBOE.

2. FINAL JUDGMENT on CBOE's claim for declaratory judgment of non-

infringement is GRANTED in favor of CBOE and against ISE.

3. FINAL JUDGMENT on CBOE's claim for declaratory judgment of

invalidity on claims 2, 4, 5 is GRANTED for indefiniteness under 35 U.S.C. § 112.

CBOE's remaining declaratory judgment claims of invalidity against ISE are

DISMISSED WITHOUT PREJUDICE, without waiving CBOE's right to reassert the

claims in this action if the appellate court remands the case to the District Court or

refuses to hear the merits of the appeal.

A3

4.   CBOE does not infringe claims 1-6, 9, 10, 35-36, 43, 45, and 56 of the
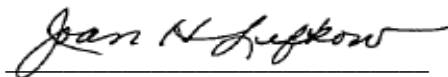
'707 patent.

5.   Claims 2, 4, and 5 of the '707 patent are invalid as indefinite under 35

U.S.C. § 112.

6.   Costs are awarded to CBOE, the prevailing party. The deadline for CBOE

to submit a proposed Bill of Costs is thirty (30) days from entry of this Final Judgment.

7.   The Court will entertain an "exceptional case" motion by CBOE under

35 USC § 285 and/or a motion for sanctions that is to be filed by CBOE within forty-five

(45) days after the return of the mandate from the circuit court of appeals.

8.   Subject to Paragraphs 4, 5, and 7 hereof, all claims between the parties

have now been resolved. This is a final and appealable judgment.

IT IS SO ORDERED, ADJUDGED, and DECREED
this 10th day of April, 2013.

_____

Joan Humphrey Lefkow
United States District Judge

A4

Order Form (01/2005)

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/6/2013
CASE TITLE	CBOE vs. ISE		

DOCKET ENTRY TEXT

This document is temporarily filed under seal to allow the parties to review whether any portions are redactable as highly confidential. The seal on the document will be lifted at 5:00 p.m. on March 14, 2013 unless a motion to seal is filed before that time. CBOE's motion in limine No. 1 (#518) to preclude argument and evidence that CBOE Infringes the '707 patent is granted in part and denied in part as set out in the Statement below.

■[For further details see text below.]

STATEMENT

　　　　CBOE argues that the issue of infringement should not be tried because ISE has conceded that CBOE's Hybrid exchange system does not infringe. CBOE rests on ISE's argument in seeking reconsideration of the court's claim construction of "automatic exchange" that expressly stated that a system that "permits matching or allocating through [open outcry] is not an automatic exchange." Thus, if CBOE's Hybrid system permits matching or allocating through open outcry, CBOE argues, ISE cannot prove infringement. ISE argues that CBOE is basing its position on the "faulty premise" that ISE must prove that there is no interaction whatsoever between CBOEdirect and floor based trading. ISE expects to demonstrate that, although CBOEdirect may route orders to the floor, CBOEdirect also matches and allocates without the use of open outcry; thus, CBOEdirect is an automatic exchange.

　　　　The issue for trial is whether Hybrid is merely two independent exchanges, one an "automatic exchange" (CBOEdirect) and the other open outcry on the trading floor, or whether it is an integrated system that requires interaction with the trading floor.[1] As such, ISE will have the burden to demonstrate (1) that each element (*e.g.*, interface, book memory means and processor means) of one or more claims is present in CBOEdirect, and (2) that Hybrid's "rule-based order routing algorithm" does not include matching or allocating through open outcry. This is necessary because the '707 patent disavows floor based trading. In other words, ISE must prove that Hybrid is a system for executing trades of financial instruments that is fully computerized, such that it does not include matching or allocating through the use of open outcry.

　　　　ISE may offer evidence that the elements of the claims of the '707 patent are found in CBOEdirect but it may not argue that, therefore, CBOEdirect infringes or that Hybrid's algorithm that includes routing orders to the trading floor is irrelevant.

A5

STATEMENT

1.CBOE holds a patent known as "the '650 patent" in which its Hybrid trading system was distinguished over prior art (in relevant part) on the basis of its "unique rule-based order routing algorithm which integrates the features of open-outcry trade execution with electronic order trade execution." See Opinion and Order of Mar. 2, 2011, at 5. (Doc. 363). As the court presently recalls, CBOE's expert at the claim construction hearing testified that Hybrid would not function without the element of the trading floor.

A6

Order Form (01/2005)

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/6/2013
CASE TITLE	CBOE vs. ISE		

DOCKET ENTRY TEXT

This document is temporarily filed under seal to allow the parties to review whether any portions are redactable as highly confidential. The seal on the document will be lifted at 5:00 p.m. on March 14, 2013 unless a motion to seal is filed before that time. CBOE's motion in limine No. 2 (#545) to preclude argument and evidence that fails to apply the proper construction of "automated exchange" and to strike ISE's infringement report to the extent it contains such arguments is granted as set out in the Statement below.

■[For further details see text below.]

STATEMENT

As stated in the ruling on CBOE's motion in limine No. 1,

> The issue for trial is whether Hybrid is merely two independent exchanges, one an "automatic exchange" (CBOEdirect) and the other open outcry on the trading floor, or whether it is an integrated system that requires interaction with the trading floor. As such, ISE will have the burden to demonstrate (1) that each element (*e.g.*, interface, book memory means and processor means) of one or more claims is present in CBOEdirect, and (2) that Hybrid's "rule-based order routing algorithm" does not include matching or allocating through open outcry.

To the extent that Dr. Ma opines as to CBOEdirect, he will be offering proof of (1) above. If he (or another witness) has not disclosed an opinion as to (2), there will be a failure of proof. *BASF Agro B.V.* v. *Makhteshim Agan of North Amer., Inc.*, 2012 WL 84985 (2012 WL 84985), relying on Federal Circuit case law, supports this court's view that by "disavow[ing] "traditional floor-based trading,"[1] the invention of the '707 patent does not encompass Hybrid unless ISE can also establish that it is actually two independent trading systems. *See id.* at *3. ("[A] patentee can rebut the presumption stemming from use of the word "comprising" by clearly disavowing certain unrecited elements and thereby actively excluding those elements from the scope of the patent's claims."). Although ISE has a different view of the case and of the import of the Federal Circuit's opinion, the Federal Circuit neither held nor indicated that this court's view of the issue for trial stated in its ruling on CBOE's motion for summary judgment, is incorrect, namely, whether Hybrid is actually two independent exchanges, one an "automatic exchange" (CBOEdirect) and the other open outcry on the trading floor, or whether it is an integrated system that requires interaction with the trading floor. Therefore, Dr. Ma may testify but may not express an opinion that CBOEdirect infringes unless ISE can show that the system of CBOEdirect is independent of floor-based trading.

A7

STATEMENT

1. *Chicago Bd. Options Exchange, Inc.* v. *International Securities Exchange, LLC*, 677 F.3d 1361, 1372 (Fed. Cir. 2012).

A8

Order Form (01/2005)

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/7/2013
CASE TITLE	CBOE vs. ISE		

DOCKET ENTRY TEXT

This document is temporarily filed under seal to allow the parties to review whether any portions are redactable as highly confidential. The seal on the document will be lifted at 5:00 p.m. on March 14, 2013 unless a motion to seal is filed before that time. CBOE's motion *in limine* no. 3 (519-1) to (1) preclude argument at trial concerning claims already found invalid is denied as stated below.

■[For further details see text below.]

STATEMENT

Claim 2

The court construed claim 2's "means for matching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis" as having a structure that is "[a] general purpose computer under the control of a software system; a network of general purpose computers, each under the control of a separate software program; or a system of interconnected parallel processors." (Claim Construction Ruling, Dkt. #286 at 7.) The court noted a means-plus-function claim must disclose structure in the specification, namely "the algorithm disclosed in the specification." (Attachment A to Claim Construction Ruling, Dkt. #286 at 15.) It concluded that the portions of the specification (18:1-18, 18:61-19:5) on which ISE relied for structure was not such an algorithm. CBOE believes this requires to the court to find claim 2 invalid.

ISE argues that this court's construction of claim 2's "means for matching" was partly misunderstood and partly incomplete, and ISE should be allowed to offer evidence that the patent specification adequately discloses an algorithm as corresponding structure.[1] The Federal Circuit ruled that this court erred in defining "matching" as a process based on price only, pointing out that claim 2, for example, "provides that matching is based on a pro rata basis." *Chicago Bd. Options Exch., Inc.* v. *Int'l Sec. Exch., LLC*, 677 F.3d 1361, 1370 (Fed. Cir. 2012). This error does not affect this court's construction of "means for matching," however, where it specifically referred to ISE's references for structure, which describe allocating on a *pro rata* basis.

While sufficiency of the disclosure is judged according to a person of ordinary skill in the art standard, that analysis is not relevant in a case where no structure is present. *See Noah Sys., Inc.* v. *Intuit Inc.*, 675 F.3d 1302, 1312 (Fed. Cir. 2012); *see also Aristocrat Techs. Austl. Pty Ltd.* v. *Int'l Game Tech.*, 521 F.3d 1328, 1337 (Fed. Cir. 2008); *Amtel Corp.* v. *Info. Storage Devices, Inc.*, 198 F.3d 1374, 1378 (Fed. Cir.

A9

STATEMENT

1999). In the case of a computer implemented invention, this structure must be an algorithm. *Aristocrat Techs. Austl. Pty Ltd.*, 521 F.3d at 1333. "The usage 'algorithm' in computer systems has broad meaning, for it encompasses 'in essence a series of instructions for the computer to follow[.]'" *Typhoon Touch Techs., Inc.* v. *Dell, Inc.*, 659 F.3d 1376, 1385 (Fed. Cir. 2011) (quoting *In re Waldbaum*, 457 F.2d 997, 998 (1972)). "Precedent and practice permit a patentee to express that procedural algorithm 'in any understandable terms including as a mathematical formula, in prose, or as a flow chart, or in any other manner that provides sufficient structure.'" *Id.* at 1385 (citing *Finisar Corp.* v. *DirecTV Grp., Inc.*, 523 F.3d 1323, 1340 (Fed. Cir. 2008)). "[I]n return for generic claiming ability, the applicant must indicate in the specification what structure constitutes the means. 'If the specification is not clear as to the structure that the patentee intends to correspond to the claimed function, then the patentee has not paid the price but is rather attempting to claim in functional terms unbounded by any reference to structure in the specification.'" *Biomedio, LLC* v. *Waters Techs. Corp.*, 490 F.3d 946, 948 (Fed. Cir. 2007) (quoting *Med. Instrumentation & Diagnostics Corp.* v. *Elekta AB*, 344 F.3d 1205, 1211 (Fed. Cir. 2003)).

ISE and Dr. Ma cite language at 18:10–19:4 as disclosing the requisite structure. (Dkt. #608, ISE Resp. Ex. E ¶ 225; Dkt. #616, ISE Resp. Ex. O ¶ 290.) This passage is equivalent to the language previously considered by the court, since only 18:1–18 and 18:61–19:5 discuss matching the remaining portion. The court previously concluded that this language does not disclose an algorithm that adds any information to claims 1 and 2. ISE and Dr. Ma further cite claim language at 16:59–66. The relevant language in column16 says:

"According to Equation #1, the PMM 3 is entitled to trade 80% of the remaining 20 contracts in the incoming order, i.e., the maximum of 60% and (20/(20+5))= 80%. Thus, 16 of the remaining 20 contracts are traded against the PMM's quotation and 4 are traded against PRO #1's order at step S190 of FIG. 4(b). The 65 bid matching process 34 determines at step S164 of FIG 4(a) that the order has been completely filled and sends the matches to the execute trade process 27."

(Dkt. #616, ISE Resp. Ex. O ¶ 292.)

The court previously concluded that the language cited in columns 18-19 did not elucidate steps for allocating on a pro rata basis. If, however, *pro rata* allocation is sufficiently simple that anyone skilled in programming could create a software program for the claimed function based on the cited portions of the specification, then the requirement of structure is satisfied. *See Typhoon Touch Tech.*, 659 F.3d at 1385 ("[T]he patent need only disclose sufficient structure for a person of skill in the field to provide an operative software program for the specified function.")

In light of these observations, a question of fact remains as to whether structure is stated for claim 2 and the court will hear evidence before finally determining the issue.

1.

ISE responds (1) that CBOE's motion is a procedurally improper motion for summary judgment,

A10

which CBOE failed to bring. It is true that motions *in limine* are generally unsuited for dispositive motions that could have eliminated issues before the parties invest in trial preparation. This court limited CBOE to presenting three issues on summary judgment, however, so CBOE cannot be faulted for failing to timely present the issue. Because of the complexity of this case, the interest of orderly administration of justice augurs in favor of disposition of this issue.

A11

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/9/2013
CASE TITLE	Chicago Board Options Exchange, Inc. v. International Securities Exchange, LLC		

DOCKET ENTRY TEXT

CBOE's motion in limine No. 3 (519-2) regarding claim 4 is granted. (See statement below for details.)

■[For further details see text below.]

Notices mailed by Judicial staff.

STATEMENT

The disputed portion of claim 4 recites

> . . . means for matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker, and wherein the minimum allocation percentage is N% and the percentage of the remaining portion allocated to the order identified with the primary market maker is:
>
> X% - Max[N%, siz[pmm]/(siz[pmm]+siz[pro])]
>
> where size [pmm] is the size of the order identified with the primary market maker, and size[pro] is the sum of the sizes of the professional orders not identified with the primary market maker.

30:49ff. CBOE contends that claim 4 is invalid because the court has already determined that the specification contains no structure for "this means for matching . . ." (Dkt. No. 286 at 9-10) and the claim does not set out structure for it. ISE contends that structure is set out in claim 4. ISE also asks the court to definitively construe the claim term as not a means plus function term (rather than pose two possibilities as it did in the Final Claim Construction Ruling. *See id.*

As previously determined, "matching" means "identifying a counterpart order or quotation for an incoming order or quotation based on one or more criteria."[1] *See* 677 F.3d at 1369-70 (holding that matching may be based on criteria other than price). "Allocating" means "dividing all or portions of the incoming order or quotation among the previously received orders and quotations." In this "means for matching" clause of claim 4 the inventor is identifying within "the remaining portion" (after public customers) the professional

A12

STATEMENT

orders/quotations that will trade where a "minimum allocation percentage" is allocated to the primary market maker. Once the minimum allocation percentage is reserved for the primary market maker, the remaining portion is matched to (or allocated among) professional orders based on designated criteria (*pro* rata, size, time priority, for example).[2]

Since matching in the disputed portion of claim 4 means identifying (matching) within the remaining portion those professional orders/quotations and counterpart orders/quotations that will trade, the formula does not set out structure for doing this. The formula (30:62) describes a method of determining the number of trades after the minimum allocation percentage is set aside. Therefore, claim 4 is construed as follows:

Function: Matching the remaining portion of orders and quotations (after the first portion has been matched) based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker.

Structure: A general purpose computer under the control of a software system; a network of general purpose computers or a system of interconnected parallel processors. No algorithm is disclosed.

Because the specification does not disclose an algorithm for the function, it is indefinite.

_____

1. The Federal Circuit ruled that matching can be based on criteria other than price. *See* 677 F.3d at 1370

2. The Federal Circuit, in holding that matching can be based on criteria other than price, seems to merge matching and allocating. As this court previously understood the patent, matching for price was a threshold to allocating according to criteria such as *pro rata*, size or time priority. If matching based on price is equivalent to matching *pro rata*, then what is allocation? Does the Federal Circuit mean that orders and quotations could be traded according to time priority without price matching? With these limitations of understanding, this court has done its best to apply the Federal Circuit's construction of "matching."

A13

Order Form (01/2005)

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/10/2013
CASE TITLE		CBOE vs. ISE	

DOCKET ENTRY TEXT

CBOE's Motion *in limine* No. 9 (#501) to preclude argument and evidence of pre-suit damages is granted. See statement section of this order for details. CBOE's Motion *in limine* No. 10 (#528) to preclude argument and evidence relating to claim construction is granted. ISE is precluded from presenting references, evidence or argument to the jury as to the proper construction of claims of the '707 patent. As set out in its order on CBOE's Motion *in limine* No. 3, part 1 (#702), the court without a jury will hear further evidence on claim 2's "means for matching" and will issue a final construction before trial. If there is a dispute between the parties about construction of "away market protection" in claim 56 the court will hear evidence and argument to resolve the issue before opening of trial. Because the court has determined in its order on CBOE's Motion *in limine* No. 3, part 2 (# ___) that claim 4 is a means plus function claim which does not specify structure, this claim will not be presented at trial. Argument will be heard on CBOE's Motion *in limine* No. 11 (#496) before opening of trial. All pending motions *in limine* are set for argument and ruling on 3/12/2013 and 3/13/2013. Jury selection will occur on Monday, 3/11/2013. Opening of trial will be postponed until Thursday, 3/14/2013.

■[For further details see text below.]

Notices mailed by Judicial staff.

STATEMENT

CBOE's Motion *in limine* No. 9 (#501) to preclude argument and evidence of pre-suit damages - **GRANTED**

    35 U.S.C. § 287(a) provides, in relevant part,

> Patentees, and persons making or selling any patented article for or under them, may give notice to the public that the same is patented, either by fixing thereon the word "patent" or the abbreviation "pat.", together with the number of the patent . . . . In the event of failure so to mark, no damages shall be recovered by the patentee in any action for infringement, except on proof that the infringer was notified of the infringement and continued to infringe thereafter, in which event damages may be recovered only for infringement occurring after such notice.

Thus, patentees may not obtain pre-suit damages unless they comply with the marking requirement or provide actual notice. The patentee bears the "burden of pleading and proving at trial that she complied with the [§ 287(a)] requirements." *Maxwell* v. *J. Baker, Inc.*, 86 F.3d 1098, 1111 (Fed. Cir. 1996); *Jackson* v. *Intel*

A14

STATEMENT

Corp., No. 09 C 2178, 2009 WL 2851742, at *2 (N.D. Ill. Aug. 31, 2009). "[P]leading that the 'infringements have been willful and with full knowledge of the . . . patents'" is sufficient to satisfy the pleading requirement. *Sentry Prot. Prods., Inc.* v. *Eagle Mfg. Co.*, 400 F.3d 910, 918 (Fed. Cir. 2005) (quoting *Dunlap* v. *Schofield*, 152 U.S. 244, 249, 14 S. Ct. 576, 38 L. Ed. 426 (1894)). While ISE did not specifically plead compliance with § 287(a) or CBOE's knowledge of the patent and its infringement, ISE's allegation of willful infringement is sufficient to plead the equivalent of CBOE's knowledge.

ISE bears the burden to show compliance with the marking statute. *See Maxwell*, 86 F.3d at 1111; *accord K&K Jump Start/Chargers, Inc.* v. *Schumacher Elec. Corp.*, 52 F. App'x 135, 141 (Fed. Cir. 2002). ISE argues that it is CBOE's threshold burden to identify the patented articles made or sold in the United States but fails to sufficiently cite authority to that effect.[1] The court will not impose a preliminary burden on CBOE in the absence of authority. ISE does not dispute CBOE's contention that it did not disclose details of its argument for pre-suit damages in response to CBOE's Interrogatory No. 11.[2] Instead, ISE argues that it did not respond to CBOE's requests because CBOE did not first disclose its arguments related to § 287(a). ISE also does not argue that the expert report of Christopher Gerardi presents such a theory.

A party must timely supplement its interrogatory responses if it "learns that in some material respect the disclosure or response is incomplete or incorrect, and if the additional or corrective information has not otherwise been made known to the other parties during the discovery process or in writing." Fed. R. Civ. P. 26(e)(1)(A). Failure to timely supplement prohibits a party from using that information as evidence unless the failure was substantially justified or harmless. Fed. R. Civ. P. 37(c)(1); *see Musser* v. *Geneva Health Servs.*, 356 F.3d 751, 758 (7th Cir. 2004). Additionally or alternatively, the court may impose other appropriate sanctions including prohibiting the disobedient party from supporting or opposing designated claims or defenses. Fed. R. Civ. P. 37(c)(1)(C). The court has broad discretion to determine whether a discovery violation was justified or harmless, *David* v. *Caterpillar*, 324 F.3d 851, 857 (7th Cir. 2003), and the following factors should guide the court's discretion "(1) prejudice or surprise to party against whom evidence is offered; (2) ability of party to cure prejudice; (3) likelihood of disruption to trial; and (4) bad faith or willfulness involved in not disclosing evidence at an earlier date." *Tribble* v. *Evangelides*, 670 F.3d 753, 760 (7th Cir. 2012) (citing *David*, 324 F.3d at 857).

The court looks to the factors above to determine the sufficiency of ISE's disclosure. First, although ISE sufficiently pleaded CBOE's knowledge of the patent and its infringement, ISE did not disclose its theory that it was not required to mark because it did not make or sell the invention after issuance of the patent. Failure to present this theory until the motion *in limine* stage prejudices CBOE as it prepares for trial. Because ISE forwarded its theory on the eve of trial, there is little opportunity to cure the prejudice without disruption. Furthermore, ISE admitted its failure to disclose and did not point to accident as the reason for this failure. Therefore, the court finds sanctions under Rule 37(c)(1) appropriate, and ISE will not be permitted to present evidence of pre-trial damages at trial.

---

[1] ISE cites to two Central District of California cases to support the proposition that CBOE bears a preliminary burden. *See In re Katz Interactive Call Processing Litig.*, 821 F. Supp. 2d 1135 (C.D. Cal. 2011) (hereafter "*In re Katz*"); *Unova Inc.* v. *Hewlett-Packard*, No. 02-cv-3772, 2006 WL 5434534 (C.D. Cal. Feb. 16, 2006). The *In re Katz* court stated, "[a]lthough . . . there is a split in authority, we chose to follow our own precedent." *In re Katz*, 821 F. Supp. 2d at 1159. The court did not cite any Federal

A15

Circuit cases to support its framework, and neither opinion includes sufficient reasoning to persuade this court to adopt a similar approach. ISE further cites *Broadcom Corp.* v. *Agere Systems Inc.*, No. 04-cv-2416, 2004 WL 2009320 (E.D. Pa. Sept. 8, 2004). The court in *Broadcom* reasoned that it could not determine whether the products were "patented articles" until it conducted *Markman* hearings and did not explicitly endorse the burden shifting scheme proposed by ISE. *Id.* at *4.

[2.] Interrogatory No. 11 instructs, "[i]dentify all legal and factual bases for any damages that ISE contends it is entitled to recover from CBOE, including but not limited to the amount and type of such damages, the specific methodology used to arrive at such amounts, and the persons having knowledge of, or information relating to, any basis for such damages." (Dkt #552, CBOE Mot. *in Limine* Ex. 20, at 2).

Order Form (01/2005)

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/12/2013
CASE TITLE	CBOE vs. ISE		

DOCKET ENTRY TEXT

Motion by ISE for clarification (#699) as to the court's rulings on CBOE's motion in limine no. 1 (#694) is denied for reasons stated on the record on 3/11/2013. Motion by CBOE (#675) for leave to file amended pretrial exhibit list (#675) is granted in part and reserved in part. Motion by ISE for protective order (#681) is granted. See statement section of this order for details. The parties agree (a) to permit counsel to make interim statements, (b) to allow the jury to ask questions under court supervision, and (c) to allow the jury to discuss the case during the trial if all jurors are present and willing to engage in discussion.

■[For further details see text below.]

Notices mailed by Judicial staff.

STATEMENT

Motion by CBOE for leave to file Amended Pretrial Exhibit List (#675) - **Granted in part, reserved in part**

1.   Amendment of exhibit list

CBOE moves to amend its pretrial exhibit list. This request is granted on the following conditions. While CBOE can introduce exhibits to support the availability of prior art references, it may not introduce new prior art references which were not produced during discovery. The parties will work together to resolve specific issues and objections. CBOE to submit a revised list of disputed articles by 3/13/2013. Ruling on remaining disputed exhibits is reserved until this time.

2.   Number of references

Given the extensive list of prior art references on which CBOE intends to rely to establish invalidity and the large number of disputed alleged prior art references, the court will limit CBOE to twenty-five prior art references as provided in the Local Patent Rules. *See* N.D. Ill. L.P.R. 3.1 ("Final Invalidity Contentions may rely on more than twenty-five (25) prior art references only by order of the Court upon a showing of good cause and absence of unfair prejudice to opposing parties.").

3.   Standard for printed publications

Because CBOE bears the burden on invalidity, it also has the burden of qualifying references as prior art printed publications. "Whether an asserted anticipatory document qualifies as a 'printed publication' under § 102 is a legal conclusion based on underlying factual determinations." *Cooper Cameron Corp.* v. *Kvaerner Oilfield Prods., Inc.*, 291 F.3d 1317, 1321 (Fed. Cir. 2002). "In order to qualify as a printed

A17

STATEMENT

publication within the meaning of 35 U.S.C. § 102, a reference 'must have been sufficiently accessible to the public interested in the art.'" *In re Lister*, 583 F.3d 1307, 1311 (Fed. Cir. 2009) (quoting *In re Cronyn*, 890 F.2d 1158, 1160 (Fed. Cir. 1989)). Public accessibility is the "touchstone in determining whether a reference constitutes a 'printed publication.'" *In re Hall*, 781 F.2d 897, 898–99 (Fed Cir. 1986). "Whether a reference is publicly accessible is determined on a case-by-case basis based on the 'facts and circumstances surrounding the reference's disclosure to members of the public.'" *In re Lister*, 583 F.3d at 1311 (quoting *In re Klopfenstein*, 380 F.3d 1345, 1350 (Fed Cir. 2004)).

A reference is publicly accessible if it was "disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it." *Kyocera Wireless Corp.* v. *Int'l Trade Comm'n*, 545 F.3d 1340, 1350 (Fed. Cir. 2008) (quoting *SRI Int'l, Inc.* v. *Internet Sec. Sys. Inc.*, 511 F.3d 1186, 1194 (Fed. Cir. 2008)). If CBOE establishes a prima facie case of availability, the burden will shift to ISE to rebut availability as of the critical date. *See In re Lister*, 583 F.3d at 1317. Where a reference is available in a library, CBOE must establish that "the research tools available would have been sufficient to permit an interested researcher to locate and examine the reference" as of the critical date. *In re Lister*, 583 F.3d at 1311. Although cataloguing and indexing are not required, they can establish that a reference was available. *See id.* at 1312; *Klopfenstein*, 380 F.3d at 1348.

Motion by ISE for protective order (#681) - **Granted**

ISE argues that CBOE should not be permitted to serve subpoenas on the University of Chicago, Northwestern University, and Loyola University Chicago. ISE argues that CBOE is attempting to use this testimony to conduct fact discovery on the availability dates of alleged prior art documents. Given the document production requests in the subpoenas, the court agrees that CBOE is seeking further discovery from non-party witnesses. (*See, e.g.*, Dkt. #683, ISE Mot. for Protective Order Ex. A. at Sched. A.) Although "the scope of material obtainable by a Rule 45 subpoena is as broad as permitted under the discovery rules," *Williams* v. *Blagojevich*, No. 05 C 4673, 2008 WL 68680, at *3 (N.D. Ill. Jan. 2, 2008), fact discovery closed in June 2009 and CBOE has not timely moved to reopen discovery for this purpose, particularly where ISE notes that in its interrogatory responses it repeatedly stated that CBOE failed to establish that each reference cited was prior art. (*See* Dkt. #683, ISE Mot. for Protective Order Ex. D at 6, 9-10, 22-25.) Although ISE did not give CBOE an exhaustive list of documents to which it objected, CBOE could have sought additional discovery at the time. On the eve of trial, CBOE cannot complain of prejudice when it had many opportunities to conduct the necessary fact discovery.

This said, the parties are to work together to prepare a list of usable prior art references where public availability is not genuinely disputed.

A18

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/12/2013
CASE TITLE	CBOE vs. ISE		

DOCKET ENTRY TEXT

Motion by CBOE in limine No. 15 To Preclude ISE's Expert From Testifying To Facts Not Properly Disclosed During Discovery (#505) is granted in part and denied in part. See statement section of this order for details. Motion by CBOE in limine No. 18 To Preclude Argument and Evidence that Contravenes The Court's Construction of Allocating Preferentially Against Professional Orders and Quotations with Larger Size (#537) is granted. Motion by CBOE in limine No. 20 To Preclude Argument and Evidence Regarding Any Previous Work That ISE's Damages Expert May Have Performed For CBOE's Counsel (#514) is granted as unopposed. Motion by CBOE in limine No. 21 To Preclude ISE From Arguing the Scope of Disavowal (#646) is mooted by the court's rulings on CBOE's motions in limine No. 1 and 2 (#694 & #695). Motion by ISE No. 1 to Preclude Dr. Benn Steil from Testifying Regarding Allegations, Analyses, Conclusions or Opinions Not Disclosed in His Expert Reports (#468) is granted in part and denied in part. Dr. Steil may testify as to those opinions disclosed in his reports so long as they are not based solely on legal conclusions that have been communicated to him. Motion by ISE No. 2 to Preclude CBOE from Rearguing Claim Construction (#471) is denied. See statement section of this order for details.

■[For further details see text below.]

Notices mailed by Judicial staff.

STATEMENT

Motion by CBOE in limine No. 15 - **Granted in part, denied in part**

Under Federal Rule of Evidence 702, an expert witness may testify if, *inter alia*, "the testimony is the product of reliable principles and methods." Fed. R. Evid. 702. Under Rule 703, an expert may testify to facts or data

> . . . that the expert has been made aware of or personally observed. If experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion on the subject, they need not be admissible for the opinion to be admitted.

Fed. R. Evid. 703. The boundary of this permission is not well defined. As stated in the advisory committee notes,

A19

STATEMENT

Some types of expert testimony will be more objectively verifiable, and subject to the expectations of falsifiability, peer review, and publication, than others. Some types of expert testimony will not rely on anything like a scientific method, and so will have to be evaluated by reference to other standard principles attendant to the particular area of expertise. The trial judge in all cases of proffered expert testimony must find that it is properly grounded, well-reasoned and not speculative before it can be admitted.

Fed. R. Evid. 702 advisory committee notes, 2000 amend. CBOE has not challenged the qualifications of Dr. Ma to testify. Thus, the court will allow him to state his opinions and the bases therefor. With respect to evaluating the prior art and opining on the inferences to be drawn from it, Dr. Ma's opinions must be based on his scientific and engineering knowledge. Thus, he may not rely on random hearsay statements of unidentified individuals to form the basis of his opinion. He may rely on his personal experience in "designing exchanges" so long as the specific knowledge derived from experience is explicitly given. The concerns CBOE expresses about the bias of the witness and the quality of his testimony can be explored on cross-examination. To the extent inadmissible evidence is received that may mislead the jury, CBOE may ask for a limiting instruction.

CBOE's objections to late disclosure are overruled. It appears from the record that CBOE's expert witnesses have had ample opportunity to evaluate the report. CBOE, also, has submitted an expert report that ISE argued was filed too late. The parties' positions are well-known to the opposition.

Motion by ISE in limine No. 2 - **Denied**

1. Allocating preferentially according to size

The court construed the term "allocating a remaining portion of the incoming order or quotation preferentially against professional orders and quotations with larger size" as "allocating a remaining portion of the incoming order or quotation according to the size of the order or quotation, from largest to smallest." Dr. Steil testified that this clause means that the largest order is filled first and, if a portion remains, the next largest order is filled, and so forth, until there are no more trades available. (Dkt. #484, Ex. B, Steil Dep. at 188-190.) Plainly, claim 1 claims allocating sequentially according to size, as ISE's counsel argued at the claim construction hearing. If this clause were interpreted as merely allocating proportionally according to size, *i.e.*, *pro rata*, it would not be distinct from claim 2.

2. Orders and quotations

An order is different from a quotation. An order connotes an instruction to purchase or sell. A quotation is not an instruction to purchase or sell. The parties agreed to definitions for each of these terms. They are not incorrect.

A20

Order Form (01/2005)

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/13/2013
CASE TITLE	CBOE vs. ISE		

DOCKET ENTRY TEXT

Order entered on 3/7/2013 (Dkt. #702) is amended as follows: motion by CBOE in limine no. 3 (#519) to preclude argument at trial concerning claims already found invalid is reserved as to claim 2. Enter order: Motion by CBOE in limine no. 3 to preclude argument at trial concerning claims already found invalid (#519) is granted as to claim 2. (*See* #707 re: claim 4.) Motion by ISE in limine no. 3 to preclude CBOE from offering argument and testimony concerning the "automated exchange" and "matching" claim terms inconsistent with the Federal Circuit's constructions (#474) is denied. Motion by CBOE in limine no. 11 to preclude argument and evidence that contravenes the construction of matching and allocating (#496) is granted. Motion by CBOE in limine no. 12 to preclude argument and evidence that relies on ISE's rejected construction of matching (#523) is granted. Motion by CBOE in limine no. 13 to preclude argument and evidence that conflates the construction of orders and quotations (#494) is granted. See order dated 3/12/2013 (#713). ISE's oral motion of 3/13/2013 to reconsider ruling on CBOE's motion in limine no. 18 concerning allocating preferentially according to size (#713) is denied. The court's use of the term "from largest to smallest" indicates sequence. ISE did not appeal the court's construction of the term and it is too late to do so now. See statement section of this order for details.

■[For further details see text below.]

Notices mailed by Judicial staff.

STATEMENT

1.   <u>Means for matching, claim 2</u>

On March 13, 2013, the court heard evidence and argument concerning whether the specification contains structure for claim 2's "means for matching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis." Col. 30:15–19. The structure on which ISE relies is found at Figures 4(a) and 4(b) and column 16. Figure 4(a) illustrates a bid matching process and an allocation algorithm. Figure 4(b) sets out detail for the allocation algorithm. The bid matching process appears to apply to public customer orders, directing that those orders be filled first. If there are no public customer orders at the lowest offer (*i.e.*, best price) (S150) or if the order is not filled in full by the public customers (S170), then the bid matching process determines whether there are orders that can be traded after the primary market maker's small order preference is honored. (S152.) If so, those orders ("the remaining portion") are sent through an allocation algorithm that sets out steps for dividing them amongst professionals on a pro rata basis. The formulae at column 16:36 ff. demonstrate how this division is done. To the extent that there needs to be structure for a "means for allocating" (which is not at issue), plainly this is structure.

Dr. Ma testified and ISE argues, however, that the allocation algorithm is actually within the larger

A21

STATEMENT

process of bid matching and that allocation is the math that takes place within the allocation algorithm to divide the size of the order (to buy) by the number of contracts (for sale) to reach a number of shares per professional order. Yet another step remains, Dr. Ma testified, which is to match a particular buyer with the particular contracts being offered so they may be sent for execution of trades. If this is what the inventor meant as matching,[1] the specification does not disclose how that type of matching is done. Rather, it tells a person of ordinary skill in the art how to "divid[e] all or portions of the incoming order or quotation among the previously received orders and quotations," *i.e.*, to allocate. (Dkt. #286 at 4.) Moreover, ISE has not explained how its "matching" structure can be differentiated from allocating consistently with the ruling of the Federal Circuit, which rejected its argument that "matching" and "allocating" "are part of a single process," *Chicago Bd. Options Exch., Inc.* v. *Int'l Sec. Exch., LLC*, 677 F.3d at 1361, 1370 (Fed. Cir. 2012), stating:

> As the first example [in the specification] indicates, all incoming orders initially are "matched" to public customer orders, and where no incoming orders remain to be filled, the order is executed. In the second example, the incoming order is initially "matched" to the available public customer orders. Where there are remaining incoming orders, the balance of the incoming order is then "allocated" among quotations and professional orders. In addition, the '707 Patent's abstract describes an "exchange [that] *allocates* the *matching* of orders first to fill customer orders and then to fill professional orders on a pro rata basis." These examples show that "matching" occurs at some point that is distinct from "allocating."

Id. at 1371 (emphasis in original). That the court rested on examples demonstrating that matching occurred *before* allocating, points to the conclusion that ISE's position simply lacks foundation in the patent or in the opinion of the Federal Circuit.

For these reasons the court concludes that the specification does not disclose structure for claim 2's "means for matching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis." As a result, claim 2 is indefinite and, therefore, invalid.

2.   Automated exchange

ISE continues to argue that the court's jury instruction for "automated exchange" as set out in the order of January 14, 2013 (#643) is improper because it considers that the accused "automated exchange" in this case is CBOEdirect rather than Hybrid, as this court has determined. The court has considered ISE's position several times, both in briefs and on the record, and is unpersuaded that the order is erroneous or that Hybrid is not the accused "automated exchange."

1. Gary Katz, the inventor testified quite the contrary at his deposition:

> Matching is when two prices are the same to buy and to sell and does not get into the definition of how one shares buyers' and sellers' trades against each other. The allocation is the process by which it is decided which buyers and which sellers interact at the matched price.

(Katz Dep. at 162–63.)

A22

United States District Court, Northern District of Illinois

Name of Assigned Judge or Magistrate Judge	Joan H. Lefkow	Sitting Judge if Other than Assigned Judge	
CASE NUMBER	07 C 623	**DATE**	3/14/2013
CASE TITLE	CBOE vs. ISE		

DOCKET ENTRY TEXT

CBOE's motion in limine No. 19 to preclude infringement argument and evidence that contravenes the language of claim 56 (511) is granted. See statement section of this order for details. CBOE's motion (705) to reconsider ruling on CBOE's motion in limine no. 4 (701) is denied without prejudice. The motion may be renoticed if and when this case goes to trial. CBOE's motion in limine no. 14 to preclude argument and evidence that contravenes the obviousness legal standard (531) and CBOE's motion to exclude Dr. Ma's improper expert opinions (549) are denied without prejudice. These motions may be renoticed if and when this case goes to trial. Orders 707 and 713 are amended as stated in the statement section of this order.

■[For further details see text below.]

Notices mailed by Judicial staff.

STATEMENT

New Rulings

CBOE's motion in limine No. 19 (#511) to preclude infringement argument that contravenes the language of claim 56 is granted.

Statement:

    The process of the automated exchange of claim 56 includes "querying an away market to determine an away market price." (Col. 39:21–22.) The process of claim 58, which is dependent on dependent claim 57, states "wherein the step of querying further comprises receiving market price information from a reporting entity." (Col. 39:38–40.) CBOE believes that "querying" is different from "receiving" because claim 58's "querying" is limited to using market price information received from a reporting entity, for example, Options Price Reporting Authority (OPRA). ISE contends that this motion is not timely and amounts to a motion for summary judgment in that it raises claim construction issues. The claim term of claim 56 is not ambiguous and has never been disputed. Thus, ISE must be careful not to offer evidence of "querying" that would "read on" claim 58 or argue that CBOE's use of market price information received from a reporting entity infringes claim 56.

A23

STATEMENT

Amended Orders

The second paragraph, first sentence, of the order of 03/09/2013 (#707) is amended to read as follows: "As previously determined, 'matching' means 'identifying a counterpart order or quotation for an incoming order or quotation.'" 677 F.3d at 1371.

Paragraph 1 of the ruling on ISE's motion in limine no. 2 in the statement attached to the order entered 03/12/13 (#713) is amended to read as follows:

1. Allocating preferentially according to size

The court construed the term "allocating a remaining portion of the incoming order or quotation preferentially against professional orders and quotations with larger size" as "allocating a remaining portion of the incoming order or quotation according to the size of the order or quotation, from largest to smallest." (Dkt. #286 at 5.) The construction was different from ISE's proposed construction (and from CBOE's). ISE did not seek reconsideration; neither did it include this term in its appeal to the Federal Circuit. CBOE's expert, Dr. Steil, relied on this construction in forming his opinions. (*See* Dkt. #484, Ex. B, Steil Dep. at 188-190.) ISE argues that the court's construction is ambiguous, thus producing a question of fact for the jury. The term "from largest to smallest" can only mean a sequential filling of orders. There is no ambiguity. The court concedes that the claim term might have been construed more broadly,[1] but ISE's presentment of its proposed construction in motions in limine is untimely and prejudicial to CBOE.

---

1. "Might have been" is the operative phrase here. ISE points to nothing in the specification that describes an algorithm for dividing other than *pro rata* or "weighted" *pro rata*. Although the specification speaks of favoring orders and quotations of larger size, this seems intended to point out an improvement over prior art by changing the allocation from the professional's "location in the allocation rotation" (Col. 2:51–56) to the algorithm described in figs. 4(a) and 4(b) (various steps for determining the amount of the remaining portion and its *pro rata* allocation). *See Metabolite Labs., Inc.* v. *Lab. Corp. of Am. Holdings*, 370 F.3d 1354, 1360 (Fed. Cir. 2004) ("In most cases, the best source for discerning the proper context of claim terms is the patent specification wherein the patent applicant describes the invention."). Thus, the specification does little to assist ISE in supporting an alternative to the court's construction of claim 1 that would distinguish it from claim 2. *See Phillips* v. *AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005) ("[T]he presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim.").

A24

**UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION**

CHICAGO BOARD OPTIONS EXCHANGE,
INCORPORATED,

      Plaintiff,

          v.

INTERNATIONAL SECURITIES EXCHANGE,
LLC,

      Defendant.

Case No. 07 CV 0623

Hon. Joan H. Lefkow

FINAL CLAIM CONSTRUCTION FOR U.S. PATENT NO. 6,618,707

A25

I.   AGREED TERMS

Claim or Term Element	Construction Agreed to by Parties	Court's Construction
"public customer orders" (All Asserted Claims)	Orders entered on behalf of any party that is not a registered broker-dealer.	Accepted.
"order" (All Asserted Claims)	An instruction on behalf of a professional or public customer to purchase or sell an instrument, the order having a size associated therewith.	Accepted.
"quotation" (All Asserted Claims)	An indication by a market maker of the price at which it is willing to buy or sell an instrument for which it has been assigned to create a market, the quotation having a size associated therewith.	Accepted.
"allocating parameters" (All Asserted Claims)	Parameters for dividing portions of the incoming order or quotation among the previously received orders and quotations.	Rules for dividing portions of the incoming order or quotation among the previously received orders and quotations.
"parameters for allocating a first portion of the incoming order or quotation against previously received customer orders" (Claims 1-3; 6; 9-10)	Parameters for allocating a first portion of the incoming order or quotation against previously received customer orders.	Rules for allocating a first portion of the incoming order or quotation against previously received customer orders.
"processor means for allocating portions of	Function: Allocating portions of the	Accepted.

2

A26

the incoming order or quotation among the plurality of previously received orders and quotations in the book memory means based on the allocating parameters in the system memory" (Claims 1-6; 9-10; 22-24; 27)	incoming order or quotation among the plurality of previously received orders and quotations based upon the allocation parameters in the system memory. Structure: A general purpose computer, a network of general purpose computers, or a system of interconnected parallel processors including an algorithm that divides the incoming order and quotation among the previously received orders and quotations.
	Accepted.

3

A27

Case 1:07-cv-00623   Document 286   Filed 01/25/10   Page 4 of 16

II.   DISPUTED TERMS

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction	
"automated exchange" (All Asserted Claims)	An "automated exchange" is a fully computerized exchange in which no matching or allocating is performed manually in open outcry.	An exchange that includes a system that automatically matches incoming orders and quotations with stored orders and quotations.	CBOE's construction is accepted.	
"professional orders" (All Asserted Claims)	Orders entered on behalf of registered broker-dealers, including Primary Market Makers (PMMs), Competitive Market Makers (CMMs) and Electronic Access Members (EAMs).	Orders entered on behalf of registered broker-dealers.	CBOE's construction is accepted.	
"allocating" (Claims 1-6; 9-10; 22-24; 27)	Dividing portions of the incoming order or quotation among the previously received orders and quotations. "Allocating" is a process that is distinct from "matching."	Dividing all or portions of the incoming order or quotation among the previously received orders and quotations.	Dividing all or portions of the incoming order or quotation among the previously received orders and quotations. "Allocating" is a process that is distinct from "matching."	

4

A28

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
"matching" (Claims 2-5; 35-36; 43; 45; 56-58; 61)	Identifying a counterpart order or quotation for an incoming order based on price. "Matching" is a process that is distinct from "allocating."	Identifying a counterpart previously received order or quotation for receiving a portion of an incoming order.	CBOE's construction is accepted.
"allocating a remaining portion of the incoming order or quotation preferentially against professional orders and quotations with larger size" (Claims 1-3; 6; 9-10)	Allocating larger portions of a remaining incoming order or quotation to professionals quoting or ordering larger size.	Allocating a remaining portion of the incoming order or quotation in a preferred manner against professional orders and quotations that are larger in size than other professions orders and quotations in the book memory means.	Allocating a remaining portion of the incoming order or quotation according to the size of the order or quotation, from largest to smallest.
"pro rata" (Claims 2 and 36)	In proportion according to size.	Based on a percentage of the size of a professional's order or quotation with reference to the total size of the professional orders and quotations at the same price.	CBOE's construction is accepted.
"the remaining portion" (Claims 2 and 3)	The portion of the incoming order or quotation that is allocated preferentially against professional orders and quotations with larger size.	The portion allocated in a preferred manner against professional orders and quotations that are larger in size than other professional orders and quotations in the book memory.	ISE's construction is accepted.

5

A29

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
"book memory means" (Claims 1-6; 9-10; 22-24; 27)	Function: The book memory means stores a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith and the previously received orders including public customer orders previously entered for public customers and professional orders or quotations previously entered for one or more professionals. Structure: Book memory 33	Function: Storing a plurality of previously received orders and quotations to trade a corresponding plurality of quantities of the instrument. Structure: Memory	Function: Storing a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith. Structure: Book memory 33

6

A30

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
"system memory means" (Claims 1-6; 9-10; 22-24; 27)	Function: The system memory means stores allocating parameters for allocating trades between the incoming order or quotation and the previously received orders and quotations. Structure: System memory 26, bid matching process 34 and offer matching process 36	Function: Storing allocating parameters. Structure: Memory	Function: Storing parameters of the entity administering the invention for allocating trades between the incoming order or quotation and the previously received orders and quotations. Structure: CBOE's construction is accepted.
"means for matching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis" (Claim 2)	Function: Matching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis. Structure: A general-purpose computer or a network of general-purpose computers or a system of interconnected parallel processors, but there is no disclosure of the steps such general-purpose computer(s) would perform	Function: Matching the remaining portion with professional order or quotations in the book memory means on a pro rata basis. Structure: A general purpose computer, a network of general purpose computers, or a system of interconnected parallel processors including an algorithm comprising the step of matching the remaining portion	Function: Agreed construction is accepted. Structure: A general purpose computer under the control of a software system; a network of general purpose computers, each under the control of a separate software program; or a system of interconnected parallel processors Note: (See Attachment A).

7

A31

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
		based on a percentage of the size of a professional's order or quotation with reference to the total size of the professional orders and quotations at the same price.	
"means for matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker"	Function: Matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker.	Function: Matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker.	Function: Agreed construction is accepted.
(Claims 3 & 4)	Structure: A general-purpose computer or a network of general-purpose computers or a system of interconnected parallel processors programmed to perform the steps of FIG. 4(b) for bids and FIG. 5(b) for offers.	Structure: A general purpose computer, a network of general purpose computers, or a system of interconnected parallel processors including an algorithm that matches a minimum allocation percentage to a primary market maker comprising the following steps: 1) calculating a primary market maker's minimum allocation percentage of the remaining portion; 2) calculating the primary market	Structure: A general purpose computer under the control of a software system; a network of general purpose computers, each under the control of a separate software program; or a system of interconnected parallel processors programmed to perform the steps of Fig. 4(b) for bids and Fig. 5(b) for offers. Note: ISE's construction is descriptive of the steps set out in Figs. 4(b) and 5(b). The text from col.15, 119 - col.19, 1.6 applies specific steps

8

A32

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
		maker's pro rata allocation of the remaining portion; and 3) matching the greater of the two to the quotation identified with the primary market maker.	identified in Figs. 4(b) and 5(b) as the way to allocate the PMM's share of the remaining portion. CBOE's construction is more faithful to the rule that the specification must disclose the particular structure that is used to perform the recited function. *Blackboard, Inc. v. Desire2Learn, Inc.*, 2009 WL 2215104, *14 (Fed. Cir. July 27, 2009).
"means for matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker, and wherein the minimum allocation percentage is N% and the percentage of the remaining portion allocated to the order identified with the primary market maker is: $X\% = \text{Max}[N\%, siz[pmm] / (siz[pmm]+siz[pro])]$	Function: Matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker, and wherein the minimum allocation percentage is N% and the percentage of the remaining portion allocated to the order allocated to the primary market maker is: $X\% = \text{Max}[N\%, siz[pmm] / (siz[pmm]+siz[pro])]$	Function: Matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker. Structure: A general purpose computer, a network of general purpose computers, or a system of interconnected parallel processors including an algorithm that matches a minimum allocation percentage to a primary market maker comprising the following steps:	Note: The specification does not contain any reference to this means for matching. Rather, the claim itself contains an algorithm (series of steps) sufficient to accomplish the function of allocating the remaining portion to the quotation identified with the primary market maker according to the particular formula recited within the claim. See *MicroChemical, Inc. v. Great Plains Chemical Co.*, 194 F.3d 1250, 1257 (1999) ("If the word 'means' appears in a claim element in association with a function, this court presumes that § 112, ¶ 6 applies. This presumption collapses, however, if the claim itself recites sufficient structure,

9

A33

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
where siz[pmm] is the size of the order identified with the primary market maker, and size[pro] is the sum of the sizes of the professional orders not identified with the primary market maker." (Claim 4)	where siz[pmm] is the size of the order identified with the primary market maker, and size[pro] is the sum of the sizes of the professional orders not identified with the primary market maker. Structure: A general-purpose computer or a network of general-purpose computers or a system of interconnected parallel processors, but there is no disclosure of the steps such general-purpose computer(s) would perform.	1) calculating a primary market maker's minimum allocation percentage of the remaining portion; 2) calculating the primary market maker's pro rata allocation of the remaining portion; and 3) matching the greater of the two to the quotation identified with the primary market maker	material, or acts to perform the claimed function.")(cit. omit.). If, however, this is incorrect, and it should be construed as means plus function, then the function must be the entirety of claim 5 text at col.30, ll.49-67, and the structure is a general purpose computer under the control of a software system; a network of general purpose computers, each under the control of a separate software program; or a system of interconnected parallel processors, programmed to perform the formula recited in claim 4.
"means for matching a first portion of the incoming order or quotation against customer orders and a remaining portion of the incoming order or quotation against professional orders and quotations" (Claim 4)	Function: Matching a first portion of the incoming order or quotation against customer orders and a remaining portion of the incoming order or quotation against professional orders and quotations. Structure: A general-purpose computer or a network of general-purpose computers or a system of interconnected parallel processors programmed to	Function:Matching a first portion of the incoming order or quotation against customer orders and a remaining portion of the incoming order or quotation against professional orders and quotations Structure: A general purpose computer, a network of general purpose computers, or a system purpose computers, or a system of interconnected parallel processors including an	Function: Agreed construction is accepted. Structure: A general purpose computer under the control of a software system; a network of general purpose computers, each under the control of a separate software program; or a system

10

A34

Case 1:07-cv-00623 Document 286 Filed 01/25/10 Page 11 of 16

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
	perform the steps of FIG. 4(a) for bids and the steps of FIG. 5(a) for offers.	algorithm that matches a first portion of an incoming order or quotation against customer orders and a remaining portion of the incoming order or quotation. Wherein the algorithm comprises the steps of: 1) determining whether there are customer orders stored in the book memory means, and if so; 2) matching a first portion of the incoming order or quotation against customer orders; 3) determining whether there are any remaining portions of the incoming order, and if so; 4) matching a remaining portion (after step 2) against professional orders and quotations.	of interconnected parallel processors, programmed to perform the steps of FIG. 4(a) for bids and the steps of FIG. 5(a) for offers. Note: ISE's construction is descriptive of the steps set out in FIG. 4(a) and FIG 5(a). The text from col.15, l.19 - col.19, l.6 applies specific steps identified in FIG. 4(a) and FIG. 5(a) as the way to allocate the first portion of the incoming order or quotation against customer orders and a remaining portion of the incoming order or quotation against professional orders and quotations. CBOE's construction is more faithful to the rule that the specification must disclose the particular structure that is used to perform the recited function. *Blackboard, Inc. v. Desire2Learn, Inc.,* 2009 WL 2215104, *14 (Fed. Cir. July 27, 2009).*

11

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
"away market querying means for determining an away market price for the instrument" (Claim 22)	Function: The away market querying means determines an away market price for the instrument. Structure: A general-purpose computer or a network of general-purpose computers or a system of interconnected parallel processors, but there is no disclosure of the steps such general-purpose computer(s) would perform.	Function: Determining an away market price for the instrument Structure: A general purpose computer, a network of general purpose computers, or a system of interconnected parallel processors including an algorithm comprising the steps of querying a reporting entity for an away market price for an away market price for an instrument and receiving an away market price for such instrument.	Function: ISE's construction is accepted. Structure: A general purpose computer under the control of a software system; a network of general purpose computers, each under the control of a separate software program; or a system of interconnected parallel processors.
"away market process means for entering a matching quotation at the away market price if the processor means determines that the away market price is better than the best price" (Claim 23)	Function: Entering a matching quotation at the away market price if the processor means determines that the away market price is better than the best price. Structure: A general-purpose computer or a network of general-purpose computers or a system of interconnected parallel processors programmed to perform the steps of FIG. 9.	Function: Entering a matching quotation at the away market price if the processor means determines that the away market price is better than the best price on the automated exchange. Structure: 1) A general purpose computer, a network of general purpose computers, or a system of interconnected parallel processors including an algorithm comprising the steps of:	Function: ISE's construction is accepted. Structure: A general purpose computer under the control of a software system; a network of general purpose computers, each under the control of a separate software program; or a system of interconnected parallel processors

12

A36

Claim Term or Element	CBOE's Construction	ISE's Construction	Court's Construction
		A) determining the price difference between the away market price and the best price; B) determining the number of contracts that a market maker is willing to execute at the price differential determined in Step 1; and C) if the size of the incoming order or quotation is less than or equal to the number identified in Step 2, execute the trade for the number of contracts at the away market price. OR 2) Computer workstations, personal computers, minicomputers, mainframe computers, personal digital assistants, or web TV boxes.	programmed to perform the steps of FIG. 9.

13

A37

Claim Term or Element	CBOE's Construction	ISE's Construction	Agreed Construction
"alerting means for generating an alert signal if the size is greater than the matching size" (Claim 27)	Function: Generating an alert signal if the size is greater than the matching size. Structure: A general-purpose computer or a network of general-purpose computers or a system of interconnected parallel processors programmed to perform the steps 344 and 346 of FIG. 9.	Function: Generating an alert signal if the size is greater than the matching size. Structure: A general purpose computer, a network of general purpose computers, or a system of interconnected parallel processors including an algorithm that comprising the steps of determining whether the size of the incoming order or quotation is greater than the matching size and sending a notification message if that is the case.	Function: Agreed construction is accepted. Structure: A general purpose computer under the control of a software system; a network of general purpose computers, each under the control of a separate software program; or a system of interconnected parallel processors programmed to perform the steps 344 and 346 of FIG. 9.

Enter: January. 25, 2010

_____
United States District Judge

14

A38

ATTACHMENT A

As stated in *Aristocrat Technologies Australia Pty., Ltd.* v. *Int'l Game Technology*,
521 F.3d 1328, 1333 (2008), "In cases involving a computer-implemented invention in which the
inventor has invoked means-plus-function claiming, this court has consistently required that the
structure disclosed in the specification be more than simply a general purpose computer or
microprocessor. The point of the requirement that the patentee disclose particular structure in the
specification and that the scope of the patent claims be limited to that structure and its equivalents
is to avoid pure functional claiming." The case further explains, "[T]he corresponding structure
for a § 112 ¶ 6 claim for a computer-implemented function is the algorithm disclosed in the
specification." *Id., quoting Harris Corp. v. Ericsson Inc.,* 417 F.3d 1241, 1249 (2005).

As the court understands the claims, the function of the processor means recited in claim 1
is to allocate first the orders/portions of orders according to rules that require customer orders to
be filled before professional orders and quotations, and to allocate the portion remaining for
professional orders and quotations based on size, from larger to smaller. The function of the
processor means of claim 2 is to allocate orders/portions of orders according to rules that require
customer orders to be filled before professional orders and quotations, and allocate the portion
remaining for professional orders and quotations on a pro rata basis.

> ISE relies on column 18, lines 1-18 as the necessary algorithm(s) for structure:
> The remainder of the order is filled by the professional, PRO #1 and PRO #2 on a
> ro rata basis. Although PRO #1 has time priority, PRO #2 has a greater size so his
> share is computed first. PRO #2 has 20 out of the 30 contracts of the orders placed
> by the two professionals at the lowest offer and is entitled to 66% of the 6
> remaining contracts, or 4 contracts. The remaining 2 contracts are traded by PRO
> #2.

ISE also cites similar language at 18:61 - 19:5. These explanations do nothing more, however,
than explain that professional orders are not allocated by time priority but according to percentage

15

A39

share, *i.e.*, pro rata. These statements do not add information beyond what is already in claims 1

and 2.

16

A40

The United States of America

The Director of the United States Patent and Trademark Office

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extensions.

Director of the United States Patent and Trademark Office

A114

NOTICE

If the application for this patent was filed on or after December 12, 1980, maintenance fees are due three years and six months, seven years and six months, and eleven years and six months after the date of this grant, or within a grace period of six months thereafter upon payment of a surcharge as provided by law. The amount, number of timing of the mainte-nance fees required may be changed by law or regulation. Unless payment of the applicable maintenance fee is received in the United States Patent and Trademark Office on or before the date the fee is due or within a grace period of six months thereafter, the patent will expire as of the end of such grace period.

A115

US006618707B1

(12) **United States Patent**

Gary

(10) Patent No.: **US 6,618,707 B1**

(45) Date of Patent: **Sep. 9, 2003**

(54) **AUTOMATED EXCHANGE FOR TRADING DERIVATIVE SECURITIES**

(75) Inventor: **Katz Gary**, Plainview, NY (US)

(73) Assignee: **International Securities Exchange, Inc.**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/433,613**

(22) Filed: **Nov. 2, 1999**

Related U.S. Application Data

(60) Provisional application No. 60/106,935, filed on Nov. 3, 1998.

(51) Int. Cl.[7] G06F 17/60
(52) U.S. Cl. 705/37; 705/36
(58) Field of Search 705/37, 36, 26

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,573,747 A	4/1971	Adams et al.	340/172.5
3,581,072 A	5/1971	Nymeyer	235/152
4,412,287 A	10/1983	Braddock, III	364/408
4,674,044 A	6/1987	Kalmus et al.	364/408
4,903,201 A	2/1990	Wagner	364/408
4,980,826 A	12/1990	Wagner	364/408
5,101,353 A	3/1992	Lupien et al.	364/408
5,136,501 A	8/1992	Silverman et al.	364/408
5,297,032 A	3/1994	Trojan et al.	364/408
5,305,200 A	4/1994	Hartheimer et al.	364/408
5,664,115 A	9/1997	Fraser	705/37
5,689,652 A	11/1997	Lupien et al.	395/237
5,715,402 A	2/1998	Popolo	395/237
5,787,402 A	7/1998	Potter et al.	705/37
5,905,974 A	5/1999	Fraser et al.	705/37
5,913,202 A	6/1999	Motoyama	705/35
5,924,082 A	7/1999	Silverman et al.	705/37
5,946,666 A *	8/1999	Nevo et al.	705/36
5,970,479 A	10/1999	Shepherd	705/37
5,978,779 A	11/1999	Stein et al.	705/37

6,014,643 A *	1/2000	Minton	705/37
6,016,483 A *	1/2000	Rickard et al.	705/37
6,035,288 A	3/2000	Solomon	705/37
6,076,068 A	6/2000	DeLapa et al.	705/14
6,112,189 A *	8/2000	Rickard et al.	705/37

FOREIGN PATENT DOCUMENTS

WO	WO 93/15467	8/1993
WO	WO 97/42591	11/1997
WO	WO 98/38844	9/1998

OTHER PUBLICATIONS

Management Science, vol. 43, No. 12, Dec. 1997, Eric K. Clemons, Information Technology and Screen–Based Securities Trading.

Wall Street & Technology, vol. 15, No. 3, Mar. 1997, Schmerken, Ivy, "The Pandora's Box over Autoquotes."

How is a Trade Executed–Limit Order. Printed from the Nasdaq Web Page on Mar. 7, 2000.

(List continued on next page.)

Primary Examiner—Eric W. Stamber
*Assistant Examiner*—John Leonard Young
(74) *Attorney, Agent, or Firm*—Stephen J. Lieb; Frommer, Lawrence & Haug LLP

(57) **ABSTRACT**

An automated exchange is provided for matching incoming orders for the purchase or sale of financial instruments, such as options contracts, with previously received orders. The exchange allocates the matching of orders first to fill customer orders and then to fill professional orders on a pro rata basis. A primary market maker is given preference over other market professionals. Market professionals that enter larger orders into the book receive a proportionally larger portion of the incoming order. The exchange automatically maintains a minimum size by deriving orders for professionals across a range of prices when orders at the market price are exhausted. The exchange automatically derives orders for professionals to join with market-improving orders when the market-improving orders are less than the minimum market size.

75 Claims, 23 Drawing Sheets

A116
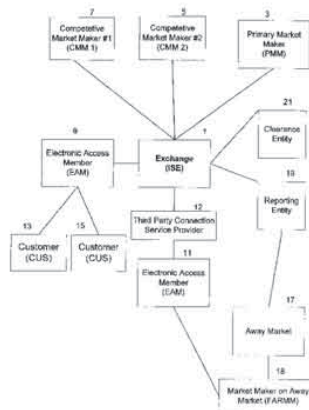
US 6,618,707 B1

Page 2

OTHER PUBLICATIONS

How is a Trade Executed–Market Order. Printed from the Nasdaq Web Page on Mar. 7, 2000.

Cosgrove, Suzanne. Courting Retail, Institutional Customers, CBOE , AMEX Get Creative. Knight–Ridder Financial News, Jan. 29, 1993.

Michaels, George. Distributed Electronic Ordering System, financial software from Financial Technology Corp. Wall Street Computer Review, Vol 8, No. 11, pp. 53–55.

Amihus et al. Liquidity, Asset Prices and Financial Policy. Financial Analysts Journal, vol. 47, No. 6, pp. 56–66.

Actualidad Economica: Free–For All In Electricity Sector? Dialog Article, p. 18, Sep. 30, 1996.

Souter, Gavin. Bermuda's Reinsurers Eager to Please, Dialog Article, Business Insurance, vol. 28, No. 44, p. 77, Oct. 31, 1994.

Guardian, UK: Branch Closures Hit Poorer Customers, Dialog Article, p. 18 Feb. 11, 1997.

* cited by examiner

A117

FIG. 1

FIG. 2

FIG. 3(a)

FIG. 3(b)

FIG. 3(c)

FIG. 3(d)

FIG. 4(a)

FIG. 4(b)

FIG. 5(a)

FIG. 5(b)

FIG. 6

A128

FIG. 7

FIG. 8

A130

Away Market Process

S340

Determine the price difference between the PMM's quote and the away market price.

S342

Retrieve PMM's away market matching table.

S344

Is the Order size less than the maximum volume at the price differential?

No →

S346

Store hidden Order in book memory and alert the PMM

Yes

S348

Trade the Order with the PMM at the away market price.

S350

Return.

FIG. 9

A131

FIG. 10(a)

FIG. 10(b)

A133

FIG. 10(c)

FIG. 10(d)

FIG. 11(a)

FIG. 11(b)

FIG. 11(c)

S610

PMM test
rotation

S612

PMM opening
rotation

S614

Are all series open?

S616

Opening
complete

Yes

No

S618

Status is trying
to open for all
series not open

FIG. 12

A139

FIG. 13

US 6,618,707 B1

1

AUTOMATED EXCHANGE FOR TRADING DERIVATIVE SECURITIES

RELATED APPLICATIONS

The present invention is disclosed in a provisional application filed under 35 U.S.C.§111(b), U.S. Application No. 60/106,935, filed Nov. 3, 1998. Priority is hereby claimed under 35 U.S.C.§119(e) for that earlier filed provisional application.

FIELD OF THE INVENTION

This invention relates generally to markets for the exchange of securities, and more particularly to an automated exchange for the trading of options contracts, that equitably allocates trades among market professionals and assures liquidity.

BACKGROUND OF THE INVENTION

The options market first developed in the 1970s. Since that time, options for the purchase and sale of listed stocks have traded domestically only on floor-based exchanges, for example, the American Stock Exchange (AMEX). The method of trading options contracts in these floor-based environments is known as an "open outcry" system because trading takes place through oral communications between market professionals at a central location in open view of other market professionals. In this system, an order is typically relayed out to a trader standing in a "pit." The trader shouts out that he has received an order and waits until another trader or traders shouts back a two-sided market (the prices at which they are willing to buy and sell a particular option contract), then a trade results. In an effort to preserve this antiquated system of floor-based trading, the transition to and use of computer-based technology on these exchanges has been slow. Although some processes that take place on these floor-based exchanges have been automated or partially automated, they are not fully integrated and, in fact, many processes continue to function manually. As a result, there are many problems with the existing floor-based system that have caused large inefficiencies and inadequacies in order handling and price competition in the options market, and have harbored potential for abuse and mistakes.

By way of background, several of the floor-based markets rely on the skills of market professionals, known as specialists, who are responsible for maintaining an orderly market and providing liquidity. Specialists accept orders, establish prices for a particular series of options and allocate trades among market professionals. In return for accepting these responsibilities, specialists oftentimes are assured minimum participation rights in the trading activity that occurs in the pit. As is discussed below, this participation right is not exercised over the smaller-size public customer market orders that trade with the single display systems. Instead, it is up to a specialist to claim the minimum amount of trading through the orders that are routed into the pit for trade-by-trade execution.

Specialists are part of a larger class of market professionals, known as market makers, who like specialists, are responsible for maintaining liquidity in the market. Market makers fulfill this responsibility by ensuring that there is always a two-sided market through calling out prices (quotations) at which they are both willing to buy (bid) and sell (offer) a particular option contract and honoring those quotations when trading with incoming orders. In the traditional open outcry system, market makers call out these

2

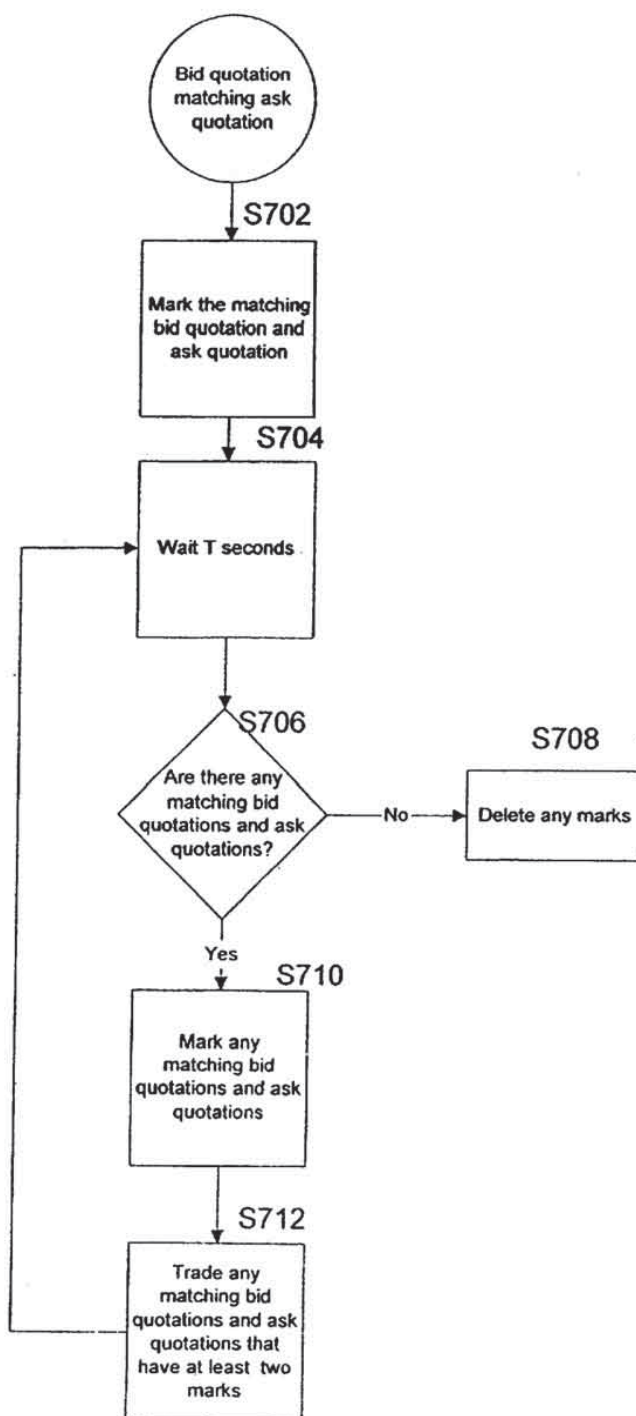quotations each time an order is routed into the trading pit. Over time, each of the existing options exchanges has developed systems to track the best quotation. What generally happens is that market makers call out quotations which are manually entered into a system that tracks and displays the single best bid and best offer for the entire trading pit at any given time. As the market makers continue to call out new quotations, the system is updated to reflect the current best bid and best offer. In their existing state, these quotation systems do not track or identify which market maker called out the quote currently displayed or the number of contracts (size) for which the market maker is willing to honor at that quotation. As is discussed below, these systems simply display a single quotation for the entire pit that is generally understood to be valid (firm) for only smaller-sized orders, for example 10 contracts, and for only certain types of orders, for example public customer orders entered on an exchange for immediate execution at the existing market price (the best bid or offer) known as "market orders." The floor-based exchanges generally have procedures for the automatic execution and allocation of these smaller-sized public customer market orders at the displayed quotations through a rotation assignment of the orders among the pit market makers.

Execution through use of the displayed quotation and automatic allocation to market makers does provide a guaranteed market for incoming smaller-sized public customer market orders. However, this system does not provide an incentive for members to make quotations for size larger than the minimum, i.e., 10 contracts from the above example. In fact, often these automatic allocation systems do not permit market makers to make quotations for larger size. Further, because the bid and offer prices for these allocation systems are set by a single quotation, the existing best bid and best offer may not always accurately reflect the desire of each and every market maker, which makes it difficult for market makers to change the quotation to reflect changes in the market. If the market for the option becomes volatile, for example, when the price of the underlying stock fluctuates or if a market maker simply changes his opinion on what a fair price for that option should be, market makers risk being forced to trade at a disadvantageous price displayed on the single quotation system.

On the other hand, market makers must trade at the displayed market price or else update the quoted price if they wish to improve the market. However, members have no incentive to quote a price that improves the market, i.e. quote a higher bid or lower offer than the current displayed market price, because these systems allocate public customer market orders to market makers in turn through a rotation process. Therefore, to what extent an individual market maker is allowed to participate in a particular order is a matter of chance and whether a market maker who quotes a better market is able capture the benefit of his quotation in a particular option series depends upon his location in the allocation rotation.

The ability for a market maker to act independently and to make deep liquid markets is severely inhibited by these single quotation allocation systems. The inherent inadequacies in these single quotation systems stem from the fact that individual market makers' quotations and size are not tracked or identified. As well the size that market makers are willing to trade at the next best prices (prices lower than the best displayed bid or higher than the best displayed offer) is not tracked or identified. These deficiencies make it difficult to assess market depth and liquidity and ultimately impact that quality of the prices customers receive for their orders.

US 6,618,707 B1

<table>
<tr><td>3</td><td>4</td></tr>
</table>

What is more, because no record of market quotations exists beyond the single quotation system it is virtually impossible to accurately recreate and document historical market conditions.

As discussed above, these existing single quotation systems generally provide a guaranteed market at the currently displayed best bid or best offer only for incoming smaller-sized public customer market orders. The execution and allocation procedures, however, are not honored for orders not meeting this criteria. Instead, non-marketable orders where a particular price is bid or offered (limit orders), orders above the minimum size, and orders placed by professionals (professional orders), for example, broker-dealers trading for firm accounts and market makers trading from other options exchanges, frequently continue to be quoted on a case-by-case basis by the market makers in the pit. These orders, therefore, do not even receive the benefit of the single quote allocation systems, which despite their shortcomings, at least afford an opportunity for quicker execution at guaranteed prices. In addition, in periods of high volatility or order volume, or similar circumstances in the trading of the underlying security, a procedure known as a fast market may be instituted. When a fast market exists, the displayed quotations are not honored and market professionals generally revert to quoting incoming orders one series at a time until the condition ultimately subsides.

When a limit order cannot be filled immediately either because the price bid or offered is outside the market or because there is inadequate size to fill the order at the volume ordered, the order is placed on a "book." A book, more accurately a limit book, is a record of outstanding public customer limit orders that can be matched against future incoming orders. Professional orders are usually not allowed on the limit book. At the existing options exchanges, these limit books may be maintained in a manual and/or electronic format. The current systems, however, generally are not integrated with the single quotation systems. Because the systems stand apart, the best bid and best offer for quotations is calculated separately from the best bid and best offer for the limit book. Moreover, professional orders are not generally accounted for in either of these two calculations. As a result, in instances where the limit book matches or betters a displayed quotation, incoming market orders are not traded automatically. In those cases, incoming smaller-size customer market orders utilizing a display quotation system instead must be "kicked out" and announced to the trading pit in open outcry or manually executed against the limit book.

Broadcast of orders on the floor on a case-by-case basis can create a disadvantage for parties wishing to place larger orders. First, trading is not anonymous. Therefore, market makers in the trading pit are able to determine to some extent the identity of the party placing the order and, as a result, oftentimes condition what they are willing to quote on, for example, whether the order is from a public customer or a market professional. Second, the fact that an order for a larger number of options contracts has been placed can have an effect on the price of the underlying stock. Persons overhearing the order placed on the floor market can "trade ahead", that is, buy or sell the underlying stock in anticipation of the owner of the options contracts exercising its options. Trading ahead violates market rules, however, because a large number of people are aware of orders placed on floor markets, effective policing of parties that trade ahead is impractical.

Under the current infrastructure, there is little accountability amongst the individual market makers to make two-sided markets with size and continuously call out quotations. The single quote display systems, on the one hand, looks to the crowd and not individuals to maintain the quotations. The traditional open outcry process, on the other hand, provides market makers with the opportunity to react to whichever orders they want to respond and to determine how they want to respond. For example, with incoming orders not routed through the single quote display systems, market makers often distinguish between public customer and professional orders and vary the quotations they are willing to trade at after learning of the order type, not before. What is more, market makers do not quote size for which they are willing to trade at the next best prices (lower than the best bid and higher than the best offer) or make distinctions on what they are willing to trade with other market professionals at the next best prices.

Beyond the trading processes internal to each option exchange, additional considerations arise when an option is listed on multiple exchanges. In order to assure that an order in a multiply-listed contract receives the best execution price, market professionals are charged with the responsibility of checking the other exchanges' quotations for prices better that the exchange's best bid or best offer and with the responsibility of contacting the other exchange to verify that the quotations are valid. If better quotation exists at another exchange, that exchange's market participants must either trade at that price or change (fade) the quotation. The incoming order is generally not automatically processed and must addressed on a case-by-case basis. This entire process of checking other exchange quotations is dependent upon the originating exchange market professionals' personal efforts to verify the other markets' quotations each time an order comes into the trading pit.

The increasing volume of trades in options contracts, as well as the speed at which price information of underlying stocks is transmitted to consumers, has increased the demand for faster trade execution in today's market. In addition, volatility in the price of underlying stocks that are the basis for options contracts place further pressure on exchanges to execute trades quickly and at an equitable price. Market makers on floor-based markets are limited in the speed at which they can react to market fluctuations and respond with quotations. This limited response speed leads to greater market volatility and lower liquidity because the market makers are less willing to risk trading large numbers of contracts where the price may not be optimal. The disjointed nature of the various manual, and sometimes automated, systems which take place on floor-based exchanges cultivate these deficiencies and, again, make it difficult to assess the true market depth and liquidity and ultimately impact that quality of the prices.

SUMMARY OF THE INVENTION

It is an advantage of the invention to provide an automated system for matching previously entered orders and quotations with incoming orders and quotations on an exchange for securities, which will improve liquidity and assure the fair handling of orders.

It is a further advantage of the invention to provide an automated exchange for securities wherein an incoming order is filled first against public customer orders and then filled against professional orders and quotations on a pro rata basis based on the size of the professional order or quotation.

It is yet another advantage of the invention to provide an automated exchange for the trading of securities wherein a primary market maker also known as a specialist is given a

A142

US 6,618,707 B1

5   6

relatively higher portion of the pro rata order volume, primary market maker being a market maker with additional responsibilities toward maintaining an orderly market.

It is yet another advantage of the invention to provide an exchange that automatically moves the price of a market maker's quotation one or more trading increments worse that the quotation price after the size of the quotation has been exhausted, such new quotation having a predetermined size that is dependent upon the price of the new quotation.

It is yet another advantage of the invention to provide an exchange that automatically guarantees a predetermined minimum number of contracts at the market price by placing a derived order for a primary market maker at the market price so that the total size at that price will be at least the predetermined minimum number of contracts.

It is another advantage of the invention to provide an automated exchange for securities that employs an auto-mated away market process to assure that orders eligible for away market protection are executed at prices better than or equal to away market prices.

It is another advantage of the invention to provide an automated exchange for securities that employs an auto-mated fast market process to reduce volatility in the market and assure that orders are executed at fair prices.

It is another advantage of the invention to provide an automated exchange for securities that employs an auto-mated opening process to assure that orders entered on an opening are executed at a fair price and that opening quotations accurately reflect the market interests.

It is yet another advantage of the invention to provide an automated exchange for securities that employs a block order process to assure that larger-sized orders are executed at a fair price.

It is another advantage of the invention to provide an automated exchange for securities. that employs a facilita-tion process to assure that larger-sized orders are executed at a fair price while guaranteeing that a minimum percentage of a larger-sized order is traded by the market professional who entered the larger-sized order, after any public customer orders at the best price or prices are executed.

It is another advantage of the invention to provide a quotation matching process whereby bid quotation and ask quotations are not immediately executed to provide an opportunity for automatic quotations system to adjust their prices before trading with a quotation generated by a faster automatic quotation system.

It is yet another advantage of the invention to provide a process whereby the size of a market maker's quotation may be automatically increased when its has a quotation at the best price and the aggregate size of the best price would fall below a minimum size, or else automatically lower the price of the quotation in the case of a bid and raise the price of the quotation in the case of an offer according to parameters established by the market maker.

It is another advantage of the invention to enable market makers to establish parameters which limit the amount of a quotation that should be made available to execute against different types of orders.

Broadly, an exchange for matching securities according to the invention stores a plurality of orders from public cus-tomers and market professionals, as well as quotations from market makers in a book memory and automatically matches incoming orders and quotations with those stored orders and quotations.

According to one option, orders stored in the book memory from public customers at the best price are matched

first and, when all stored public customer orders at the best price have been matched, then professional orders and quotations are matched on a pro rata basis.

According to another option, where the size of an incom-ing order is less than a small order preference limit, the portion of the order not matched with public customer orders in the book memory at the best price is matched with a primary market maker if it has a quotation at the best price.

According to another option, incoming orders are prefer-entially allocated to the primary market maker by providing a minimum allocation percentage to the primary market maker's quotations before matching orders and quotations among other professionals.

According to another option, when an incoming order is received that does not match with previously entered orders or quotations and improves upon the best price, but has a size less than a minimum market size, the exchange auto-matically derives an order for a primary market maker to join the order improving the best price from at least the minimum market size

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics, features, and advantages of the present invention will be apparent upon consideration of the following detailed description of the invention, taken in conjunction with the following drawings, and in which:

FIG. 1 is a block diagram illustrating an automatic exchange according to an embodiment of the invention interconnected with a plurality of market makers, exchange members, and other entities;

FIG. 2 is a detailed block diagram illustrating the exchange of FIG. 1;

FIGS. 3 through 13 are flow charts showing processing by the exchange of FIG. 1.

DETAILED DESCRIPTION

Embodiments of the invention will be described in terms of an automated exchange market for stock options, options being contracts for the purchase or sale of a listed security at a particular strike price to be exercised on a particular date in the future. The invention, however, is not limited to the sale of options contracts and may also be applied to other financial instruments such as stocks, bonds, commodity futures contracts, currency, and the like.

The embodiments will be described in terms of a market for a single option, for example a put for IBM Class A stock expiring on Jan. 15, 1999 with a strike price of 140. It is to be understood that the exchange according to the invention simultaneously provides a market for a series of options for a number of underlying stocks across a range of exercise dates and at a range of strike prices. The vast number of options that can be traded makes the invention particularly advantageous over less automated systems because many of the routine decisions made by professionals in charge of a series of options can be defined in advance and applied automatically.

An automated exchange according to the invention is administered by a business entity, for example, the Interna-tional Securities Exchange LLC (ISE) of New York, N.Y., which authorizes certain persons as members. The business entity may authorize different types of members or participants, such as a primary market maker (PMM) and one or more competitive market makers (CMMs) to enter quotations in particular classes of options. While there is only one PMM for each class of options traded on the

A143

US 6,618,707 B1

7

exchange, there may be multiple PMM participants on the exchange, each trading different classes of options. The business entity may also authorize PMMs and CMMs to place orders in options classes traded on the exchange, as. well as one or more broker-dealers to enter orders as principal or agent in options classes traded on the exchange, which broker-dealers shall be referred to herein as electronic access members ("EAMs").

Orders entered on behalf of registered broker-dealers, including PMMs, CMMs and EAMs, are referred to herein as professional orders. Orders entered on behalf of market makers on competing exchanges 18 are a particular type of professional order referred to herein as "FARMM" orders. Orders on behalf of any party that is not a registered broker-dealer are referred to as public customers orders.

It is to be understood that the names, types and arrangement of participants and orders are used as examples for purposes of illustration. It is to be understood that the particular arrangement of participants and orders may be varied and remain within the scope of the invention. According to one embodiment of the invention, three distinct type of order are defined, namely public customer orders, professional orders and FARMM orders as defined above. Nevertheless, a greater or fewer number of order types may be defined. The embodiments described herein conform to the rules imposed by a certain type of business entity. It is to be understood that an exchange which conforms to a different set of rules is nevertheless within the scope of the invention. Further, it is to be understood that the term "exchange" does not limit the use of the invention to an entity that is a registered exchange, that is, the invention may be administered by other types of business entities, such as broker-dealers, associations or others.

FIG. 1 shows an exchange 1 according to an embodiment of the present invention connected with a number of entities. An order placed on the exchange 1 may be a limit order that specifies an order size, that is, an integral number of contracts, and a bid price or offer price. Alternatively, an order may not specify a bid price or an offer price, in which case the order is referred to as a market order. It is understood that a market order is to be executed at the best available price, which is the highest price in the case of a market order to sell and the lowest price in the case of a market order to buy.

Professional orders and quotations in an options class are communicated to the exchange 1 by the PMM 3, and one or more CMMs 5, 7. One or more EAMs 9, 11 communicate public customer, professional and FARMM orders to the exchange 1. According to one embodiment of the invention, PMMs and CMMs may only enter proprietary quotations and orders, that is they may not enter orders as an agent on behalf of a public customer or another professional.

The exchange 1 is also connected with a reporting entity 19. The reporting entity 19 may be, for example, the Options Price Reporting Authority (OPRA), which collects price and size data for all options traded on exchanges in the United States and provides this data to subscribers. The exchange 1 communicates the prices of each trade to the reporting entity 19. The exchange also communicates the best prices available, that is the highest bid price and the lowest offer price in the book memory 33 discussed below. The reporting entity 19 may also include the Consolidated Trading System/ Consolidated Quoting System (CTS/CQS), which collects price data on underlying stock markets. According to one embodiment of the invention applied to the trading of options, the exchange 1 collects data from the reporting

8

entity 19 and uses this information in its automatic trade execution process, described below. Data from the reporting entity 19 is also used to monitor prices of options on other markets 17, as well as that of stocks underlying the options to, among other functions, assess whether a "fast market" condition exists, that is, whether the other exchanges have indicated that due to the volume and/or price volatility of a security, certain of their normal trade execution rules will not apply.

The exchange 1 is also connected with a clearance entity 21. The clearance entity may be, for example, The Options Clearing Corporation (OCC). The clearance entity 21 performs the transactions necessary to clear the trade, including guaranteeing payment to the seller and accountability for the buyer.

Telecommunication links between the exchange and each of the entities 3–21 can be made by any of a number of known electronic data exchange mechanisms. For example, the exchange 1 may communicate to outside entities 3–21 via local area networks, wide area networks, direct electronic or optical cable connections, dial-up telephone connections, or a shared network connection including the Internet using wire and wireless based systems.

Data can be exchanged between the exchange 1 and entities 3–21 via data terminals located at the entities 3–21. Data terminals may be any of a number of known data processing machines, for example, computer workstations, personal computers, minicomputers, mainframe computers, personal digital assistants, web TV boxes, and the like. Terminals at the entities 3–21 include software capable of communication with the exchange 1 using a predetermined data format. According to one embodiment of the invention, data is exchanged with the exchange 1 using OMnet™ API software manufactured by OM Technology AB of Stockholm, Sweden. Data may also be communicated from members to the exchange through the use of third-party services 12 that connect to the exchange. According to the embodiment illustrated in FIG. 1, EAM 11 is connected with the exchange 1 via such a third party communication system 12. The third party communication system may be, for example, an independent order routing and back office service provider.

The exchange 1 may be implemented on a general-purpose computer under the control of a software program. According to one embodiment of the invention, the exchange 1 is implemented on an Open VMS system running the OM Click Exchange™ software manufactured by OM Technology AB. Alternatively, the exchange 1 can be implemented on a network of general-purpose computers each under the control of a separate software program or on a system of interconnected parallel processors. Although complex, it is believed that suitable software for performing the various functions described herein can be designed and constructed by computer programmers of ordinary skill.

FIG. 2 shows the exchange 1 in detail. Connections between the exchange 1 and entities 3–21 are made via a data interface 23. The data interface 23 performs error checking, data compression, encryption and mediates the exchange of data between the exchange 1 and entities 3–21. Orders and quotations from the PMM 3 and CMMs 5, 7, as well as orders entered by EAMs 9, 11 are placed on the exchange 1 via the interface 23.

Order and quotation information received via the interface 23 from the PMM 3, CMMs 5, 7 and EAMs 9, 11 is sent to the order process 25. The order process 25 first checks to see if the order or quotation is valid according to programmable

US 6,618,707 B1

9

parameters that reflect the particular trading rules of the entity administrating the invention. For example, according to one embodiment of the invention, if the order were a market order placed by a professional the order would be rejected because trading rules prohibit professional market orders.

The order process 25 checks whether a fast market condition exists and, if so, passes orders to the fast market process 37. The fast market process 37 provides a mechanism to dampen volatility. If it is determined that the trading volume exceeds a certain amount or market volatility would lead to inequitable trades, the exchange 1 can be placed in fast market mode with respect to one or more instruments by storing a fast market parameter in the system memory 26. The fast market process 37 introduces a delay between trades that is determined by the administering entity and may be changed based upon the market conditions so that the appropriate interval can be employed. The fast market process 37 further determines an optimal price for executions based upon orders and quotes that accumulate during the delay, which will serve to dampen price fluctuations and execute trades at equitable prices. The exchange 1 automatically monitors price and volume data received from the reporting entity 19. When the primary market for the underlying stock indicates a fast market, the exchange 1 automatically sets a fast market condition for a predetermined time interval. The fast market process 37 is described in detail below.

The order process 25 varies depending upon whether the order is a public customer order, professional order or FARMM order. Except in the case of a FARMM order, discuss below, the order process 25 checks whether the incoming order can trade against orders and quotations in the book memory 33, that is, whether the terms of an order can be satisfied by a previously entered order or quotation in the book memory 33. For example, if there is an order to sell at 3 in the book memory 33, an incoming market order to buy, or an incoming limit order to buy with a stated price of 3, or higher can trade. If the incoming order can trade and the order is a public customer order, the order process 25 checks the price on the away market 17 as reported by the reporting entity 19 to determine if there is a better price available. Should an away market 17 have a better price for the incoming order, the order process 25 sends the order to the away market process 28.

The away market process 28 either trades the public customer order automatically against the PMM 3 at the same price as the better price in the away market 17 or else stores the order in the book memory 33 and alerts the PMM 3 to the order according to a set of predetermined parameters stored in the system memory 26 by the PMM 3. The order is stored in the book memory 33, but is hidden, that is, the price of the order is not communicated to the reporting entity 19. The hidden order will be executed if an incoming order or quotation can be matched with the hidden order, the away market 17 no longer has a better price, or the PMM chooses to execute the order.

Where the order process 25 determines that there is not a better price in an away market 17, or where the order is a professional order, the incoming order is sent to the bid matching process 34 if it is an order to buy and the offer matching process 36 if it is an order to sell. The bid matching process 34 matches buy orders against orders and quotations to sell that are stored in the book memory 33. The offer matching process 36 matches incoming sell orders against orders and quotations to buy stored in the book memory 33. In both the bid matching process 34 and the offer matching

10

process 36, public customer orders at the best price are executed in time priority before professional orders and quotations at the same price. After public customer orders in the book memory 33 are executed, the bid matching process 34 and the offer matching process 36 apply an algorithm that allocates the remaining size of an incoming order among the professional orders and quotations at the best price. This trade matching algorithm is described in detail below.

Where the order process 25 determines that an incoming limit order cannot trade against orders stored in the book memory 33, or if only a portion of the incoming order can trade, the order process 25 stores the incoming order or unexecuted portion thereof in the book memory 33 unless the order contains an instruction that it should be deleted if it cannot trade with orders in the book memory 33. For example, if the highest bid stored in the book memory 33 (the best bid) is 3 and the lowest offer stored in the book memory 33 (the best offer) is 4, an order to sell with a stated price of 4 cannot trade. If the incoming limit order that cannot trade improves the market, that is if the incoming order is a limit order with a bid price higher than the best bid stored in the book memory 33 or an offer price lower than the best offer stored in the book memory 33, and the size of the order is below a specified number of contracts, the order process 25 sends the order to the derive or trade process 32 if it is a public customer order, or deletes the order if it is a professional order. The derive or trade process 32 ensures that, when the market improving order is stored in the book memory 33, there is at least a minimum market size at the new market price. Under one embodiment of the invention, market rules require that there be at least 10 contracts available at the best price at all times. Thus, if the size of the market improving order is less than 10 contracts, the derive or trade process 32 either supplements the market-improving order with an order derived on behalf of the PMM 3 or else trades the market-improving order against the PMM's account. The order process 25 also sends a public customer order to the derive or trade process 32 if the aggregate size of the best price becomes less than the minimum market size. The derive or trade process 32 is described in detail below.

According to one embodiment of the invention, there are three instances where an incoming limit order that cannot trade is not stored in the book memory 33. First, a limit order may contain special instructions that it should not be stored in the book memory 33. For example, if a limit order is designated as a fill-or-kill order, the order process 25 will delete the incoming order unless the entire size of the order can be traded against the orders and quotations in the book memory 33. Second, if a limit order is designated as an immediate-or-cancel order, the order process 25 will delete any portion of the incoming order that cannot trade against the orders and quotations in the book memory 33. Finally, according to this embodiment, a professional limit order that cannot trade at a price that is within two trading increments below the best bid or above the best offer is deleted by the order process 25, that is, no portion of the professional limit order is traded.

If an order is a FARMM order, the order process 25 sends the order to the FARMM order process 30. The FARMM order process 30 stores the order in a separate memory process and generates a message to the PMM 3 and CMMs 5, 7 that a FARMM order has been received. The PMM 3 can determine to send the FARMM order to the bid matching process 34 or offer matching process 36, or the PMM 3 can determine to execute the FARMM order.

The order process 25 sends quotations to the bid matching process 34 or the offer matching process 36 if the quotation

US 6,618,707 B1

11

can trade with an order on the book memory 33. If a quotation would match against a quotation stored in the book memory 33, the order process 25 sends the quotation to the quotation matching process 31. If a quotation cannot trade, the order process 25 stores the quotation in the book memory 33. The quotation matching process 31 will not immediately execute an incoming quotation with a quotation that is stored in the book memory 33. Rather, according to one embodiment of the invention, the exchange 1 stores a programmable parameter that indicates the amount of time that the bid matching process 34 and the offer matching process 33 will wait before matching an incoming quotation with a quotation stored in the book memory 33. The quotation matching process is described in detail below.

Quotations entered by a PMM 3 or CMM 7, 5 contain a size parameter table which instructs the order process 25 the percentage of the size of a quotation and the absolute number of contracts that should be made available to execute against professional orders or quotations, and that percentage of the size of a quotation and the absolute number of contracts that should be made available to execute against FARMM orders. For example, a PMM 3 that enters a quotation to buy 60 contracts at 4, can indicate in the quotation size parameter table that the lesser of 50% of size of the quotation or 20 contracts should be made available to be executed against a professional order or quotation and that only 25% or 35 contracts should be made available to be executed against FARMM orders. In this example, the PMM's quotation can be executed against at 4 by professional orders for a total of 20 contracts (the lesser of 50% of 60 and 20) and executed against at 4 by FARMM orders for a total of 15 contracts (the lesser of 25% of 60 and 35 contracts). The PMM will never execute more than 30 contracts total at 4, so that if the size of the quotation is reduced to 15, the PMM's quotation can not be executed against by any type of order for more than 15 contracts. If the size available for execution against a professional order or quotation or the size available to execute against a FARMM order is reduced to zero, the order process will initiation the tick-worse process 39 if a professional order or quotation or FARMM order attempts to match at the quotation price.

The block order and facilitation process 35 is an optional process that an EAM 9, 11 can choose to use when executing large-size orders. The size of an order eligible for the block order and facilitation process is variable and can be set by the entity administering the exchange 1. Block orders are sent by the order process 25 to the block order and facilitation process 35. The block order and facilitation process 35 sends a message containing certain information describing the order to the PMM 3 and CMMs 5, 7, as well as to EAMs 9, 11 with proprietary orders at the best price. The block order and facilitation process 35 allows those participants that received the message to enter individual bids or offers against the block order in the form of anonymous messages that are stored in a separate memory function, that is, such messages do not interact with orders and quotations stored in the book memory 33 and are not part of the bid matching process 34 or offer matching process 36. Because block trade information sent to participants does not include the entering broker or customer information, the party placing the block trade maintains anonymity, and because the messages are not communicated outside of the system, the participants that respond with bids and offers maintain anonymity.

Parties receiving the block order information respond within a limited time period with bids and offer messages. At

12

the expiration of the time period, the block order and facilitation process 35 calculates the best possible execution price for the block order and allocates the block order among the responders, as well as orders and quotations stored in the book memory 33, according to the algorithm contained in the bid matching process 34 and offer matching process 36. Block orders must contain a stated price. A block order may be designated as a fill-or-kill order, that is, a trade should take place only if the entire size of the order can be executed at the stated price of the order or better. If no trade is possible at the stated price or better, or if there is insufficient volume to execute the entire size of an order that is designated fill-or-kill, the block order and facilitation process 35 deletes the block order and any responses. If only a portion of a block order that is not designated fill-or-kill is executed, the block order and facilitation process 35 deletes the unexecuted portion of the block order and any unexecuted responses.

A facilitation order is a block order that the entering EAM 9, 11 wishes to trade against its own proprietary order. Facilitation orders entered into the block order and facilitation process 35 are handled the same as block orders as described above, except in the case of a facilitation order, the block order and facilitation process 35 uses an algorithm that allocates all or a portion of the facilitation order against the EAM 9, 11 that entered it. Further, in the case of a facilitation order, the order is always executed in full because the EAM 9, 11 entering the order commits to executing any amount of the order that is not executed by other participants. The block and facilitation process 35 is described in detail below.

Orders and quotations that have been executed are sent to the execute trade process 27. The execute trade process 27 instructs the order process 25 to remove the matched order from the book memory 33, and sends a message to the participants that submitted the matched orders or quotations. The execute trade process 27 also sends trade information to the clearance and reporting process 29. The clearance and reporting process 29 sends the executed trade information to the reporting entity 19 and the clearance entity 21 via the interface 23.

The final two process in FIG. 2 are the tick-worse process 39 and the step-up or tick-worse process 39, both of which apply to quotations entered by a PMM 3 or CMMs 5, 7. The tick-worse process 39 automatically changes the price and size of a quotation in the book memory 33 when the size of the quotation in the book memory 33 is reduced to zero. The tick-worse process 39 determines the new price and size according to parameters entered by the PMM 3 or CMM 5, 7. These parameters are stored in the system memory 26 with respect to each quotation entered by a PMM 3 or CMM 5, 7. The new quotation price is one or more trading increments lower for a quotation to buy and one or more trading increments higher for a quotation to sell. The step-up or tick-down process 38 increases the size of a quotation at the best price when the aggregate size of the best price would be less than the minimum market size according to parameters entered by the PMM 3 or CMM 5, 7, or sends the quotation to the tick-worse process 38. The tick-worse process 39 and the step-up or tick-down process 38 are described in detail below.

FIGS. 3(a) through 3(c) illustrating the trading process within the exchange 1 for a limit order. An order is received at step S1 by the interface 23 and passed to the order process 25. At step S3 of FIG. 3(a), the order process 25 determines whether the incoming order is valid. If the incoming order is not valid, the order process 25 rejects the incoming order

A146

US 6,618,707 B1

13

at step S5 and sends a message to the party placing the incoming order indicating that the order was rejected.

If the order is valid, then the order process 25 determines at step S7 whether the order is a block or a facilitation order. If the order is either of these, the order process 25 determines at step S9 whether the exchange is in a fast market mode, and if it is, the order process 25 rejects the incoming order at step S11 and sends a message to the party placing the incoming order. If the exchange is not in a fast market mode, the block order and facilitation process 35 is initiated at step S13.

If the incoming order is not a block order or a facilitation order, the order process 25 determines at step S15 whether the order is a FARMM order. If the order is a FARMM order, the order process 25 determines at step S17 whether the exchange is in a fast market mode, and if it is, the order process 25 rejects the incoming order at step S19 and sends a message to the party placing the incoming order. If the exchange is not in a fast market mode, the FARMM order process 30 is initiated at step S21.

If the incoming order is not a FARMM order, the order process 25 determines at step S23 whether the exchange is in a fast market mode, and if it is, the order is handled according to the fast market process 37 at step S25. If the exchange is not in fast market mode, the order process 25 determines at step S27 whether the incoming order is an order to buy or to sell.

If the incoming order is an order to buy, the order process 25 determines at step S29 of FIG. 3(b) whether the incoming order can trade with the offer side of the book memory 33. If the order cannot trade at step S29, the order process 25 determines at step S31(a) whether the order would improve upon the best bid, that is, whether the price of the order is higher than the highest order or quotation to buy stored in the book memory 33, and if it is not, the order process 25 stores the order in the book memory 33 at step S31(b). If the order would improve upon the best offer, the order process 25 determines at step S31(c) whether the size of the order is equal to or greater than the minimum market size stored in the system memory 26, and if it is, stores the order in the book memory 33 at step S31(d). If the order is less than the minimum market size, the order process 25 determines at step S31(e) whether the order is a public customer order, and if it is not, deletes the order at step S31(f). If the order is a public customer order the order process 25 sends the order to the derive or trade process 32 at step S31(g).

If the incoming order can trade with the offer side of the book memory 33 at step S29, the order process 33 determines at step S33 whether the order is a public customer order, and if it is not, the bid matching process 34 is initiated at step S35. If the incoming order is a public customer order, the order process 25 determines at step S37 whether there is a better offer in the. away market 17, and if there is not, the bid matching process 34 is initiated in step S36. If there is a better price in the away market at step S37, the order process 25 sends the order to the away market process 28 at step S39. The order process 25 will skip step S37 and send the order directly to the bid matching process 34 if the away market process 28 has been disabled at the exchange.

If the incoming order is an order to sell at step S27, the order process 25 determines at step S41 of FIG. 3(c) whether the incoming order can trade with the bid side of the book memory 33. If the order cannot trade at step S41, the order process 25 determines at step S43(a) whether the order would improve upon the best offer, that is, whether the price of the order is lower than the lowest order or quotation

14

stored in the book memory 33, and if it is not, the order process 25 stores the order in the book memory 33 at step S43(b). If the order would improve upon the best offer, the order process 25 determines at step S43(c) whether the size of the order is equal to or greater than the minimum market size stored in the system memory 26, and if it is, stores the order in the book memory 33 at step S43(d). If the order is less than the minimum market size, the order process 25 determines at step S43(e) whether the order is a public customer order, and if it is not, deletes the order at step S43(f). If the order is a public customer order the order process 25 sends the order to the derive or trade process 32 at step S43(g).

If the incoming order can trade with the bid side of the book memory 33 at step S41, the order process 33 determines at step S45 whether the order is a public customer order, and if it is not, the offer matching process 36 is initiated at step S47. If the incoming order is a public customer order, the order process 25 determines at step S49 whether there is a better bid in the away market 17, and if there is not, the offer matching process 36 is initiated in step S50. If there is a better price in the away market at step S49, the order process 25 sends the order to the away market process 28 at step S51. The order process 25 will skip step S49 and send the order directly to the offer matching process 36 if the away market process 28 has been disabled at the exchange.

FIG. 3(d) illustrates the trading process within the exchange 1 for a market order. A market order is received at step S100. The order process 25 determines at step S100 whether the order is valid, and if it is not, rejects the order at step S102. If the order is valid, the order process 25 determines at step S104 whether the exchange is in fast market mode, and if it is, sends the order to the fast market process 37 at step S106. If the exchange is not in fast market mode, the order process 25 determines at step S108 whether there is a better price in an away market 17, and if there is, sends the order to the away market process 28. If there is not a better price in an away market 17, the order process 25 determines at step S112 whether the order is to buy or sell. If the market order is a sell order, the order process 25 sends the order to the offer matching process 36 at step S114. If the market order is a buy order, the order process 25 sends the order to the bid matching process 34 at step S116. The order process 25 will skip step S108 and move directly to step S112 if the away market process 28 has been disabled by the exchange.

Trade Matching

The exchange 1 according the to the invention matches incoming orders with orders and quotations stored in the book memory 33. The order process 25 initiates the bid matching process 34 and the offer matching process 36, which contain rules that give priority to public customer orders at the best price, then allocate any remaining part of an incoming order or quotation among the professional orders and quotations on a pro rata basis. Specifically, incoming orders that match a public customer order on the book are traded first against the public customer order. If more than one public customer order is on the book at the same price, priority is assigned on the basis of entry time and trades are done on a first in, first serve basis. That is, public customer orders received earliest are traded first.

Limit orders that cross over the best price on the book will trade at the best price to the extent of the size on the book at the best price. For example, if the best order or quotation

US 6,618,707 B1

15

to buy in the book memory **33** is 4 for a total size of 20, a limit order to sell 10 at a stated price of 3½ will match at 4. Where the incoming order is greater than the size of the orders and quotations on the book at the best price, the bid matching process **34** and the offer matching process **36** will, using the priority rules discussed in the previous paragraph, first trade the incoming order against the orders and quotations at the best price and then trade the balance of the incoming order against the orders and quotations on the book at the next worse price. The process will continue until there is no more volume left in the incoming order, or there is no longer an order or quotation in the book memory **33** that can match the price of the incoming order. If there is still volume left in the incoming order and all orders and quotations on the book that can match the incoming order have been filled, the remaining volume of the incoming order is placed in the book memory **33**, and this order sets a new best price.

Where both public customer orders and professional orders and quotations are at the best price the bid matching process **34** and offer matching process **36** first fills the public customer orders. If the incoming order is below a predetermined size, for example, 5 contracts, then after public customer orders have been filled, the PMM **3** will trade exclusively the remaining size of the order if it has a quotation in the book memory **33** at the best price. When the incoming order is for more than the predetermined PMM small order preference size, the bid matching process **34** and the offer matching process **36** allocate the trade among the professional orders and quotations at the best price according to an algorithm stored in the system memory **26**.

FIGS. 4(a)–4(b) illustrate an embodiment of bid matching according to the invention FIGS. 5(a)–5(b) illustrate an embodiment of offer matching according to the invention. The operation of bid and offer matching will be described in terms of a number of examples of incoming orders made against orders and quotations stored in the book memory **33**. For these examples it is assumed that the incoming orders are not block or facilitation orders and no fast market condition exists. Further, it is assumed that there are no better prices on away markets **17**.

16

As a first example, assume that an incoming order to buy 4 contracts at 3½ is sent to the bid matching process **34** by the order process **25**. The bid matching process **34** determines at step S150 of FIG. 4(a) that there is a public customer order at the lowest offer. The bid matching process **34** trades the incoming order to buy 4 contracts with the public customer order in the book memory **33** at step S168. At step S170, the bid matching process determines that all 4 contracts in the incoming order have be matched. The match between the incoming order and the customer order in the book memory **33** is sent to the execute trade process **27** in step S172.

As a second example, assume the same book as shown in Table I and an order to buy 30 contracts at 3½ is sent to the bid matching process **34**. As shown in FIG. 4(a), the bid matching process **34** completes step S168 as above, matching 10 contracts of the incoming order with the public customer order to sell 10 contract at 3½. At step S170, however, the bid matching process **34** determines that there are still 20 contracts of the incoming order remaining and therefore moves to step S152. At step S152, the bid matching process **34** determines that the original size of the incoming order was greater than the PMM small order preference size, which is assumed to be 5 contracts for the purpose of this example. The bid matching process then applies the allocation algorithm as illustrated in FIG. 4(b).

FIG. 4(b) shows an allocation formula for matching incoming orders against quotations and professional orders at the best price, i.e., the lowest offer. According to this example, steps S180, S184, and S188 determine that there is one professional along with the PMM at the best price. According to one embodiment of the invention at step S190, the balance of the incoming order of 20 contracts is allocated among the PPM **3** and PRO#**1** according to the following formula:

$$X\% = \max[60\%, \text{siz}[pmm]/(\text{siz}[pmm] + \text{siz}[pro])] \qquad \text{Equation \#1}$$

where:

siz [pmm] is the size of the quotation for the PMM **3** at the market price; and

siz [pro] is the size of the order for the professional, PRO #**1**, at the market price.

TABLE I

BID					OFFER				
CUS	PRO #1	PMM	Total	Price ($)	Price ($)	Total	CUS	PRO #1	PMM
	10	10	20	3	3½	35	10	5	20
10	20		30	2½	3¾	10		10	

Table I shows an example of a portion of the book stored in the book memory **33**. As shown in Table I, a total of 20 contracts have been bid at 3 and a total of 30 contracts have been bid at 2½. PRO #**1**, a professional for example, an EAM **9, 11** trading on its own account, has entered an order to buy 10 contracts at 3 and the PMM **3** has placed a quotation to buy 10 contracts at 3. A public customer **13, 15** (CUS) has entered an order to buy 10 contracts at 2½ and PRO #**1** has entered an order to buy 20 contracts at 2½. The best bid price is 3.

On the offer side of the book, a public customer has entered an order to sell 10 contracts at 3½. PRO #**1** has placed an order to sell 5 contracts at 3½ and 10 contracts at 3¾. The PMM **3** has entered a quotation to sell 20 contracts at 3½. The best offer price is 3½.

If X% would result in a fractional allocation, the number allocated is rounded up to the nearest whole number. Other allocation formulas are also possible without departing from the scope of the invention. For example, a minimum percentage greater or smaller than 60% may be selected. Also, the allocations may not be a "straight-line" pro rata formula but may include weighting factors. According to Equation #**1**, the PMM **3** is entitled to trade 80% of the remaining 20 contracts in the incoming order, i.e., the maximum of 60% and (20/(20+5))=80%. Thus, 16 of the remaining 20 contracts are traded against the PMM's quotation and 4 are traded against PRO #**1**'s order at step S190 of FIG. 4(b). The bid matching process **34** determines at step S164 of FIG. 4(a) that the order has been completely filled and sends the matches to the execute trade process **27**.

A148

US 6,618,707 B1

17

18

As a third example, assume that the book memory **33** is as it appears in Table I and a limit order to sell 16 contracts at 3 is sent to the offer matching process **36** by the order process **25**. The offer matching process **36** determines at step S200 of FIG. 5(*a*) that there are no public customer orders at the highest bid price of 3. The offer matching process **36** determines at step **S202** that the original size of the incoming order was greater than the PMM small order preference size, which is assumed to be 5 contracts for the purpose of this example, and moves to apply the allocation algorithm. FIG. 5(*b*) contains a diagram of the same allocation formula discussed above in connection with the bid matching process **34** as applied in the offer matching process **36**. At step S222 of FIG. 5(*b*), the offer matching process determines that the PMM has a quotation at 3 and at steps S226 and S230, that there is one other professional order or quotation, PRO **#1**, at the same price. The incoming order is allocated according to Equation #1 in step S232. The PMM trades 60% of the order of 16 contracts, rounded up to the next whole contract, or 10 contracts. PRO **#1** trades the remaining 6contracts. In step **S212** of FIG. 5(*a*), the offer matching process **35** determines that the entire order was matched and sends the matches to the execute trade process **27** at step **5214**.

TABLE II

OFFER					
Price	Total	CUS	PRO #1	PRO #2	PMM
2½	50		10	20	20
2¼	30	10	10		10

Table II shows another example of the book. For clarity only the offer side of the book is shown. Two professionals, PRO **#1** and PRO **#2**, have placed orders along with the PMM **3** quotation and a public customer order to sell. Assume that the order for PRO **#1** at 2½ was placed before the order for PRO **#2** at 2½ SO that PRO **#1** has time priority at the lowest offer of 2½. As a fourth example, assume that an incoming customer limit order to buy 10 contracts at 2½ is enter on the exchange **1**.

The bid matching process **34** proceeds as shown in FIGS. 4(*a*) and 4(*b*). The process moves through steps S150 and S152 shown in FIG. 4(*a*), and steps S180, S184, S188 and S194, shown in FIG. 4(*b*) as described in the third example discussed above, to determine that there are two professional orders at 2½ along with the PMM's quotation. At step S196 the incoming order is allocated among the PMM **3**, PRO **#1**, and PRO **#2**. According to one embodiment, the following equation is used to allocate the order among the PMM **3** and the two professionals:

$$X\% = Max[40\%, Siz[pmm]/(Siz[pmm]+Siz[pro])] \qquad \text{Equation \#2}$$

Where:

siz [pmm] is the size of offer of the PMM **3** at the market price; and

siz [pro] is the size of the combined orders of the two professionals.

If X% would result in a fractional allocation, the number allocated is rounded up to the nearest whole number. Other allocation formulas are possible without departing from the scope of the invention. For example, a minimum percentage greater or smaller than 40% may be used. Further, the pro rata allocation can be modified by, for example, weighting factors that favor PRO **#1** or PRO **#2**. According to Equation 2, the PMM **3** is entitled sell 40% of the 10 contracts against

the incoming order, or 4 contracts. The remainder of the order is filled by the professionals, PRO **#1** and PRO **#2** on a pro rata basis. Although PRO **#1** has time priority, PRO **#2** has a greater size, so his share is computed first. PRO **#2** has 20 out of the 30 contracts of the orders placed by the two professionals at the lowest offer and is entitled to 66% of the 6 remaining contracts, or 4 contracts. The remaining 2 contracts are traded by PRO **#1**.

TABLE III

BID						
CUS	PRO #1	PRO #2	PRO #3	PMM	TOTAL	PRICE
3	20	20	10	10	63	3
10	20				30	2½

Table III shows yet another example of the bid side of the book stored in the book memory **33**, showing that three professionals, PRO **#1**, PRO **#2**, and PRO **#3**, have placed orders to buy along with a public customer order and the PMM **3** quotation at the highest bid price of 3. The three professionals PRO **#1**, PRO **#2** and PRO **#3** are listed in order of time priority.

As a fifth example, assume a public customer limit order to sell 49 contracts at 3 is entered. The offer matching process **36** proceeds as shown in FIGS. 5(*a*) and 5(*b*). The offer matching process **36** determines at step S200 that there is a public customer order at the highest bid and matches 3 contracts of the incoming order against the CUS order at step S216. The offer matching process moves to step S218 and determines that there remains 46 contracts in the incoming order, then moves to step S202 to determine that the original size of the order is greater than 5 contracts, which is the PMM small order preference size for the purposes of this example. The offer matching process **36** then applies the allocation formula and completes steps S222, S226, S230 and S234 in FIG. 5(*b*) as explained in previous examples, to determine that there are more than two professionals with orders or quotations along with the PMM **3** quotation at the highest bid price. Step S238 allocates the remaining 46 contracts among the PMM **3** and the three professionals. According to one embodiment, the order is allocated according to the following formula:

$$X\% = Max[30\%, Siz[pmm]/(Siz[pmm]+Siz[pro])] \qquad \text{Equation \#3}$$

Where:

siz [pmm] is the size of the bid of the PMM **3** at the market price; and

siz [pro] is the size of the combined orders of the three professionals.

If X% would result in a fractional allocation, the number allocated is rounded up to the nearest whole number. Other allocation formulas can be used. For example, a minimum percentage greater or smaller than 30% can be used or weighting factors can be provided to adjust the allocation among the professionals based. According to Equation 3, the PMM **3** is entitled to 14 contracts, however, the PMM's bid is for only 10 contracts at a price 3. Therefore, the PMM **3** trades only 10 contracts at 3 against the incoming order. The balance of 36 contracts are allocated among the three professionals on a pro rata basis. In this case, PRO **#1** and PRO **#2** have the same size, which is greater than PRO **#3**. Because PRO **#1** has time priority over PRO **#2**, PRO **#1** gets matched first. PRO **#1** has 40% of the orders among the professionals (20/50) and is entitled to 15 contracts, leaving

A149

US 6,618,707 B1

19

21 contracts. PRO #2 has now has the largest size and 66% of the size at the highest bid (20/30) and is matched for 14 contracts, leaving 7 contracts. PRO #3, the last remaining professional, trades the balance of 7 contracts.

The examples given here are by way of illustration only No limitation of the invention should be implied.

Tick-Worse Process

The tick-worse process 39 according to the present invention allows the PMM 3 and CMMs 5, 7, to specify a set of quotations that are automatically entered when the size of a quotation in the book memory 33 is reduced to zero. Each quotation placed by the PMM 3 and CMMs 5, 7 is associated with a quotation table for moving quotations one or more trading increments worse than the best price, a worse price being a lower price than a previously entered quotation to buy and a higher price than a previously entered quotation to sell. Table IV is an example of such a quotation table. The quotation table specifies variable volumes at which the PMM 3 and CMMs 5, 7 are willing to trade at successively lower bids or higher offers. Because this process is automatic, continuous quotations are maintained in the book memory 33 without a delay between an execution and the PMM 3 and CMMs 5, 7 manually entering another quotation.

TABLE IV

Initial Size	30 contracts
1-tick worse	10 contracts
2-ticks worse	30 contracts
3-ticks worse	0 contracts
4-ticks worse	60 contracts
5-ticks worse	60 contracts
6-ticks worse	60 contracts
7-ticks worse	60 contracts
8-ticks or more worse	100 contracts

It is to be understood that the quotation table shown in Table IV is by way of example only. A limitless number of quotation tables may be specified without departing from the scope of the invention. Further, each PMM 3 or CMM 3, 7 can specify a quotation table for each quotation entered.

In this example, the PMM 3 has placed an initial quotation for 30 contracts shown in the first line of Table IV and has specified a range of quotation sizes to be quoted when the initial quotation is exhausted. The table is stored in the system memory 26 and is retrieved by the tick-worse process 39 when needed. The depth of the table and the number of contracts for each tick level can be adjusted by the PMM 3. When the initial quotation for 30 contracts, as shown in the first line of Table IV, is exhausted, the tick-worse process 39 automatically generates a new quotation for 10 contracts at a price one tick worse than the market price. If the initial order for 30 contracts were placed at a market price of 3, then after these contracts are traded, the tick-worse process 29 automatically generates a new quotation for 10 contracts at $2^{15}/_{16}$ (assuming that below 3 the minimum trading increment is $^1/_{16}$). When the market at the price one tick worse becomes exhausted, the tick-worse process 39 enters a quotation for 30 contracts at a price two ticks worse than the original quotation and so on.

20

TABLE V

	BID			
CUS	PRO	PMM	TOTAL	PRICE
3		30	33	3
				2 15/16

Table V shows an example of the bid side of the book in which a public customer has entered an order to buy 3 contracts at 3 and the PMM 3 has entered a quotation to buy 30 contracts at 3. The PMM 3 has stored the table shown in Table IV in the system memory 26. Assume that a market order is received offering to sell 40 contracts. The order is passed to the offer matching process 36 as shown in FIGS. 5(a) and 5(b) after completing all necessary steps in FIG. 3(d) to reach S114. After steps S200 and S216 of FIG. 5(a), the incoming public customer order is matched for 3 contracts with the public customer order in the book memory 33 at the highest bid price of 3, leaving 37 contracts of the incoming market order unmatched in step S218. After step S202, the offer matching process 36 applies the allocation formula according to FIG. 5(b) and completes steps S222 and S226, matching the PMM's quotation for 30 contracts at 3 in step S228, and leaving 7 contracts of the incoming market order unmatched.

Because the full size of the PMM's quotation at 3 has been exhausted, the tick-worse process 39 is initiated as illustrated in FIG. 6. The tick-worse process 39 automatically retrieves a tick-worse value from the system memory 26 in step S301. The tick-worse value depends on the number of times the PMM 3 has been ticked down after placing the quotation with which the tick-worse table is associated. Here, since this is the first time the PMM 3 has been ticked down, a tick down value of 10 contracts is retrieved based on the table shown in Table IV. The PMM's quotation at 3 is deleted from the book memory 33 in step S302 and a new quotation for the PMM 3 is automatically entered in the book memory 33 at a price one tick worse than the deleted quotation. Thus, a quotation for 10 contracts at $2^{15}/_{16}$ is placed for the PMM 3 at step S303. At step S305 the process returns to step S212 in FIG. 5(a) and the offer matching process 36 continues at step S200, only now the highest bid is $2^{15}/_{16}$. The process moves through steps S202 and applies the allocation formula according to FIG. 5(b), matching the remaining 7 contracts against the PMM's new quotation at $2^{15}/_{16}$ that was generated by the tick-worse process 39 in step S303 above.

TABLE VI

OFFER				
PRICE	TOTAL	CUS	PRO #1	PMM
3½	60		30	30
3⅜	5	5		

Table VI shows an example of the offer side of the book. As a further example, assume that a market order to buy 75 contracts is entered. Assume also that both the PMM 3 and PRO #1, who is a CMM 5, 7 that has entered a quotation, have each entered the same quotation table shown in Table IV along with their initial quotations of 30 contracts.

The bid matching process 34 proceeds through steps S150 and S152 shown in FIG. 4(a), as described in previous examples, and applies the allocation formula according to FIG. 4(b). Both of the quotations from the PMM 3 and PRO #1 are exhausted at 3½, leaving 15 contracts of the market order unmatched. The tick-worse process 39 retrieves the

US 6,618,707 B1

21

tick-worse values for both the PMM 3 and PRO #1 in step S301 of FIG. 6, and deletes the quotations at 3½ from the book memory 33 in step S302. In step S303, the tick-worse process automatically enters new quotations for the PMM 3 and PRO #1 at the price of 3⅝ for 10 contracts each (assuming that above 3, the minimum trading increment is ⅛). At step S305 the process returns to step S164 in FIG. 4(a) and the offer matching process 36 continues, only now the lowest offer is 3⅝. The process moves to step S168 and matches 5 contracts against the public customer order to sell at 3⅝, and then moves through step S152 to apply the allocation formula, completing steps S180, S184 and S188 to match the remaining 10 contracts in step S196 according to FIG. 4(b).

Step-Up or Tick-Worse Process

FIG. 7 illustrates the step-up or tick-worse process 38. The step-up or tick-worse process 38 is initiated when there is a PMM 3 or CMM 5, 7 quotation at the best price and the size of the best price in the book memory 33 becomes less than the minimum market size set in the system memory 26. The PMM 3 or CMM 5, 7 sets a parameter Z of a certain number of contracts with respect to each quotation entered. At step S310, the step-up or tick-worse process 38 retrieves the Z parameter, and at step S312, calculates Q, which is the difference between the minimum market size and the size of the quotation at the best price at step S312. At step S314 the step-up or tick-worse process 38 determines whether there is sufficient size in the Z parameter, that is, whether Q is less than or greater than Z. If Q is greater than Z, the step-up or tick-worse process 38 initiates the tick-worse process 39 at step S316. If Q is equal to or less than Z, the size of the quotation is increase by Q at step S318, which results in the size of the quotation becoming equal to the minimum market size. Z is then decreased by Q at step S320, and the new value for Z is stored in the system memory 26 in step S322.

TABLE IX

| BID | | | | |
CUS	PRO	PMM	TOTAL	PRICE
		10	10	3
10	20		30	2½

As another example of the step-up or tick-worse process 38, Table IX shows an example of the bid side of the book. Assume a market order to sell 6 contracts is entered. The exchange 1 trades all 6 contracts in the market order against the PMM's quotation at 3 in the manner discussed with reference to FIGS. 5(a) and (b). A total of 4 contracts at the market price of 3 remain in the PMM's quotation. Assuming a minimum market size of 10 contracts, the step-up or tick-worse process 38 will either step-up the PMM's quotation to 10 contracts or initiate the tick-worse process 39 as described above. At step S312 Q is determined to be 6 (10–4). Step S314 determines whether the PMM 3 will be stepped up or ticked down by comparing Q with the Z. If Z=7 then, since Z is greater than Q, the PMM's quotation is stepped up by 6 contracts at step S318, Z is reduced to 1 in step S320, and the resulting market has a total of 10 contracts at the price of 3. The resulting book is as shown in Table X.

22

TABLE X

| BID | | | | |
CUS	PRO	PMM	TOTAL	PRICE
		10	10	3
10	20		30	2½

If however, Z=5, then since Z is less than the step-up size of 6, and the PMM 3 will be ticked-down according to the tick-worse process 39 initiated in S316.

Derive or Trade Process

The exchange 1 according to one embodiment of the present invention maintains a minimum size at the best bid and best offer, referred to herein as X. The value of X is variable and may be change in the system memory 26. According to one embodiment of the invention, the minimum market size X is 10 contracts. When an incoming public customer limit order that cannot trade improves the market (that is, when an order to buy at a price higher than the best bid in the book memory 33 or an offer to sell at a price lower than the best offer in the book memory 33) and the size of the order is less than 10 contracts, the order process 25 sends the order to the derive or trade process 32 at step S43(g) of FIG. 3(c) if it is an order to sell and at step S31(g) of FIG. 3(b) if it is an order to buy. If an incoming professional order or quotation improves the best price for less than 10 contracts, it is deleted according to steps S43(f) of FIG. 3(c) and S31(f) of FIG. 3(b).

The derive or trade process 32 will either will either automatically match an incoming public customer order that improves the market for fewer than 10 contract at the order's stated price, or else derive an order for the PMM 3 at the stated price at the order so that the size of the best price will be 10 contracts. Whether an order is automatically traded or whether an order is derived is determined by a parameter stored in the system memory 26. A variable Y, the number of contracts the PMM 3 is willing to have derived based on how much an order improves the market is entered by the PMM 3. According to one embodiment, Y can be determined using a matrix functionality shown in Table VII.

TABLE VII

If improvement =	¹⁄₁₆ then Y =	9
If improvement =	⅛ then Y =	7
If improvement =	³⁄₁₆ then Y =	4
If improvement =	¼ then Y =	2

The functionality of Table VII is based on the assumption that the further away a market improving order is from the PMM's quotation price, the more willing the PMM 3 will be to trade it rather than join it with a derived order. According to one embodiment of the invention, a market-improving order is traded away or joined with a derived order using the following formula.

If (X minus Siz[limit orders])>Y then trade against the public customer order;

If (X minus Siz[limit orders])<=Y then derive (X minus Siz[limit order]) for the PMM 3 at the new market price,

where X=minimum market size; and

Siz[limit orders]=total number of limit order contracts at the market improving price.

The PMM's derived order is only good as long as the public customer incoming order that caused it to be created

US 6,618,707 B1

23   24

remains active. If the market-improving public customer limit order is canceled or traded in full, the derived order is removed. If the market-improving public customer order is partially traded, the derived order may increase, or the balance of the market-improving customer order may be executed automatically. When new orders are placed on the book at the same price as the PMM's derived order, these new orders reduce the derived order size to minimize the number of derived order contracts necessary to maintain the minimum market size.

TABLE VIII

	BID				OFFER	
Cust	PRO	PMM	Total	Price	Price	Total
3	10	30	43	3	3¼	30
10			10	2¼	3½	20

Table VIII shows an example of bids and offers stored in the book memory 33. Assume a public customer limit order to buy 2 contracts at 3⅛ is entered. Step S29 of the bid matching process 34 shown in FIG. 3(b) determines that this order cannot trade because there are no offers to sell at less than 3¼. Step S31(a) determines that this bid would improve the market if it were entered on the book since the highest bid price is currently 3. Entering the order on the book at 3⅛ would improve the market by raising the market bid price. After determining that the order size is less than the minimum market size (assumed to be 10 contracts) at step S31(c) and that the order is a public customer order at step S31(e), the derive or trade process 32 is started at step S31(g).

The operation of the derive or trade process 32 is shown in FIG. 8. Step S331 determines the maximum derived order size, Y, allowed by the PMM 3 from the matrix provided by the PMM 3 stored in the system memory 26. Since this bid improves the market by ⅛, from 3 to 3⅛, the value of Y from Table VII is 7. Step S333 determines that the difference between the minimum market size, 10, and the incoming order 2 is, 10−2=8, which is greater than Y=7. Step S335 automatically trades the incoming order against the PMM 3 at 3⅛. The best bid price remains 3.

As a further example, assume the same book as in Table VIII. A public customer order for 4 contracts at 3⅛ is entered. Now the derive or trade process 32 at step S333 in FIG. 8 determines that the difference between the minimum market, 10, and the order size 4 is, 10−4=6, which is less than Y=7. Step S337 derives an order for the PMM 3 at 3⅛ for 6 contracts to provide a minimum market of 10 contracts at the new price of 3⅛. The public customer order at 3⅛ will always trade before the derived order. If the customer order for 4 contracts is executed in full, the derived order at 3⅛ will be deleted, and the book memory 33 will return to its state in Table VIII. If the public customer order is reduced by an execution, for example, to 2 contracts, the derive or trade process 32 will return to step S333 and determine that the difference between the minimum market, 10 and the remaining order size 2 is, 10−2=8, which is greater than Y=7. The remaining portion of the order will be executed automatically against the PMM 3 at step S335.

The determination of the maximum derived order size, Y, can be made using means other than the functionality shown in Table VII. According to one embodiment of the invention, Y depends on the absolute market price as well as on the price improvement of the incoming order.

The derive or trade process 32 will also be initiated if the best price become less than 10 contracts. For example, again assume the market illustrated in Table VIII, if the PRO order is cancelled and the PMM 3 moves its quotation to 2¼, the bid at 3 would be reduced to only the public customer order for 3 contracts. The derive or trade process 32 would be initiated by the order process, and an order would be derived for 7 contracts in step S333 as described in the previous example. Moreover, if a professional order for fewer than 10 contracts became the best bid in a similar manner to this example, the order would be automatically deleted. The step-up or tick-worse process 38 would be initiated if a quotation for fewer than 10 contracts were to be the become the best bid, as described above.

Match of an Away Market Price

According to an embodiment of the invention, prior to executing an incoming public customer order at the best price in the book memory 33, the order process 25 compares the best price in the book memory to prices quoted for the same option on the away market 17. If the price on the exchange 1 is as good as or better than the price on the away market 17, the trade is executed. If the price on the away market 17 is better than the best price on the exchange 1, the away market process 28 is initiated.

The operation of the away market process 28 is illustrated in FIG. 9. The away market process 28 first determines the price difference between the PMM's quotation in the book memory 33 and the away market price at step S340. According to one embodiment of the invention, the away market process 28 receives price information from the reporting entity 19. Step S342 retrieves the PMM's away market matching table from the system memory 26. Table XI shows an example of such a table.

TABLE XI

If away market is better by	PMM matches up to ?? contracts
<=.0625	15
<=.1250	10
<=.1875	5
<=.2500	2
<=.3125	1
<=.3750	1
<=.4375	0

The away market matching table determines a matching size that is the number of contracts that the PMM 3 is willing to execute at the better price equal to the away market for a range of price differentials between the PMM's quotation and the away market 17. According to one embodiment of the invention, the away market matching table is arranged so that the PMM 3 is more likely to change his price to execute a public customer order at the better away market price where the price differential between the PMM's quotation and the away market 17 is small. Where a large price differential exists, the PMM 3 will only trade small orders or will decline to match automatically. At step S344 the volume of the incoming order is compared with the maximum volume for the price differential given in the away market matching table. If the volume of the order is less than the volume of the order shown in the away market matching table, then step S348 automatically trades the order against the PMM 3 at the away market price. If the volume of the incoming order is greater than the volume given by the away market matching table, then step S346 alerts the PMM 3 of the price differential between the exchange 1 and the away market 17. The PMM 3 can then decide whether to trade the incoming order at the away market price.

A152

25

If an order is not traded automatically by the PMM **3** in step S348, the order is stored in the book memory **33**, but is not displayed as the best price. Rather, the order is hidden, but remains available for execution. For example, if the best bid in the book memory **33** is 4 and the best offer is 4¼, and the best bid from another market is 4⅛, a public customer order to sell at 4 that is stored at step S346 may be executed against an incoming market order or limit order to buy at 4¼ or higher. In this example, both the public customer order to sell at 4 and the order to buy received a better price.

Fast Market Process

When the market for an options contract becomes highly volatile or when the rate at which orders are received becomes too great, it is possible that the best price in the book memory **33** will not accurately reflect the true price of the market. In such situations a fast market can be initiated by the entity administering the exchange **1** by setting a fast market parameter in the system memory **26**. The exchange **1** also may monitor information received from the reporting entity **19** and automatically initiate a fast market condition is such a condition is indicated for the security underlying an option.

As shown in FIG. **3**(*a*), the order process **25** checks whether a fast market condition exists at steps S9, S17 and S23 by checking the value of the fast market parameter stored in the system memory **26**. If a fast market condition exists, the incoming order is rejected at step S11 if it is a block order or a facilitation order, and at step S19 if it is a FARMM order, otherwise the order is sent to the fast market process **37**. The fast market process **37** accumulates orders for a time period determined by the value of the fast market parameter. At the end of this time period, a trade is executed at a price calculated to clear a maximum number of orders at a single price. After the trade, incoming orders are once again accumulated for the time period and again trade at the end of the time period. This process provides an equitable price for market orders by preventing orders received within a short period of time from being traded at varying prices. The delay introduced by the fast market process also serves to dampen price fluctuations. Table XII shows an example of a range of delay time periods that can be set depending on the degree of volatility in the fast market according to one embodiment of the invention. Depending on the level of price volatility and/or trading volume, the fast market level can be adjusted to provide the desired degree of damping.

TABLE XII

Fast Market Delay Times

Fast Market Level	Delay
0	Normal Market - no delay
1	20 seconds
2	30 seconds
3	40 seconds
4	50 seconds
5	60 seconds
6	ISE staff enters the number of seconds at the time the fast market is called

The operation of the fast market process **37** is illustrated in FIGS. **10**(*a*) through **10**(*d*). Step S567 shown in FIG. **10**(*a*) selects the best (highest) bid in the book memory **33** as the current bid. Step S569 calculates the number of contracts that would trade at the current bid. Step S571 determines whether the current bid is equal to the PMM's bid. If not, step S573 selects the next lower bid and begins

26

step S569 again. If the PMM's bid has been reached, step S571 moves the process to step S577 in FIG. **10**(*b*), which selects the best (lowest) offer in the book memory **33** as the current offer. Step S578 calculates the number of contracts that would trade at the current offer. Step S579 determines whether the current offer is equal to the PMM's offer. If not, step S580 selects the next higher bid and begins step S578 again. If the PMM's offer has been reached, step S579 moves the process to step S585 in FIG. **10**(*c*).

If there only one price that maximizes the number of contracts that can be traded, step S585 trades orders at that price. If both the current bid and current offer prices will lead to the same maximum number of contracts traded, then step S589 determines whether the spread between the current bid and offer prices is an even number of ticks. If it is, orders are traded at the average of the current bid and current offer prices at step S591. If the spread is not even in step S589, the process stores a variable N, which equals the number of ticks (i.e., trading increments) in the spread minus two, and moves to step S595. If the spread is one tick wide in step S593, the process determines whether the instrument is a put option or a call option. If it is a put option, step S600 trades the orders at the lower of the prices determined in S585. If it is a call option, step S599 trades the orders at the higher of the prices determined in Step S585. Where the process moves to step S602 in FIG. **10**(*d*), it determines whether it is a call option or a put option. If it is a put option, orders are traded at the lower of the prices determine in S585 plus N ticks in step S604, and if it is a call options, orders are traded at the higher price determined in S585 minus N ticks in step S606.

Where the process moves to step S602 in FIG. **10**(*d*), it determines whether it is a call option or a put option. If it is a put option, orders are traded at the lower of the prices determine in S585 minus N ticks in step S604, and if it is a call options, orders are traded at the higher price determined in S585 minus N ticks in step S606.

Opening Process

The opening process **40** is initiated by the PMM **3** to trade orders and quotations accumulated when the exchange **1** is not executing trades, e.g., overnight. The opening process **40** employs the same process as the fast market process **37** described above and illustrated in FIGS. **10**(*a*) through **10**(*d*) with one modification. Prior to moving to steps S587 or S589 of FIG. **10**(*c*), the opening process **40** determines whether there would be any market or marketable limit order left unexecuted at the maximum price or prices. If there would not be, the opening process **40** moves to steps S587 or S589, if the there would be unexecuted market orders, the opening process moves back to step S567.

FIG. 12 illustrates how a PMM **3** initiates the opening process. In step S610, the PMM sends a message to the exchange **1** requesting that the opening process **40** test whether the opening process **40** would result in a single price where all market orders are executed as described above. The PMM **3** then instructs the exchange **1** to initiate the opening process **40**. If all of the series of an options class are able to complete the opening process **40**, the opening of the options class is complete. Any options series that could not complete the opening process **40** continues to attempt to complete the process as described with reference to FIGS. **10**(*a*) through **10**(*d*).

Block Order and Facilitation Process

The block order and facilitation process **35** is initiated in step S13 of FIG. **3**(*a*). FIGS. **11**(*a*) through **11**(*c*) illustrate

US 6,618,707 B1

27

the block order and facilitation process **35** when an order is received in step **S650**. The block order and facilitation process **35** identifies in step **S652** the PMM and CMMs assigned to the option from information stored in the system memory **26** and those participants with professional orders at the best bid or best offer for the option. The block order and facilitation process **35** then sends a messages in step **S654** to those participants identified in step **S652** informing them that a block order or facilitation order has been received. In the case of a block order, the message only includes the information about the order that EAM **9, 11** that entered the order determined should be disclosed. For example, the EAM **9, 11** could determine that the message should not contain information regarding the size of the order or the price of the order or both.

The participants that receive the message in step **S654** are given M seconds in which they can choose to respond to the message with bids and offers in step **S656**. M is a prepro-grammed parameter stored in the system memory **26** that may be varied as determined by the entity administering the exchange **1**. At the end of M seconds, the block order and facilitation process **35** determines in step **S657** whether the order is a block order or a facilitation order.

If the order is a block order, step **S658** of FIG. **11**(*b*) determines whether a trade can take place, that is whether a block order to sell can be matched with responses to buy and/or buy orders and quotations in the book memory **33**, and whether a block order to buy can be matched with responses to sell and/or sell orders and quotations in the book memory **33**. If the block order can trade, step **S662** sends buy orders to step **S664** and sell orders to step **S668**, where the execution price of the block order is determined. If the order is a facilitation order, step **S680** determines whether the order is a buy order or a sell order, and sends buy orders to step **S682** and sell orders to step **S688**, where the execution price of the facilitation order is determined.

The execution price of a block order or facilitation order determined in steps **S664** and **S682** will be the price of the order unless the entire size of the order can be executed at a lower price. The execution price of a block order or facilitation order determined in steps **S668** and **S688** will be the order price unless the entire size of the order can be executed at a higher price. If there are participants that are willing to sell at a price that is lower than the execution price of a block order or facilitation order to buy, such participants are executed at the execution price in steps **S665** and **S684**, and if there are participants willing to buy at prices higher than the execution price of a block order or facilitation order to sell, such participants are executed at the execution price in steps **S669** and **S690**. Public customer orders at the execution price are executed in steps **S666, S670, S686** and **S692**.

The allocation algorithm described in FIG. **4**(*b*) is applied at steps **S667** and **S687** and the allocation algorithm described in FIG. **5**(*b*) is applied in steps **S671** and **S694**. For the purposes of the allocation algorithm illustrated in FIGS. **4**(*b*) and **5**(*b*), responses received in step **S656** are treated the same as professional orders and quotations.

TABLE XIII

OFFER IN BOOK MEMORY

Price	Total	CUS	PRO #1	PRO #2	PMM
2½	60	10	10	20	20
2¾	10		10		10

28

Table XIII shows an example of the book memory **33**. As an example of the block order and facilitation process **35**, a block order is entered by an EAM **9, 11** to buy 500 contracts at 2½. The EAM **9, 11** indicates when entering the order that the size of the order should not be revealed, only that the block order is to buy at 2½. After completing steps S3, S7 and S9 of FIG. **3**(*a*), the block order is sent to the block order and facilitation process **35** where the terms of the order are store in **S650** and a message is sent to the PMM **3**, PRO #**1**, PRO #**2** and any CMMs associated with the options class in the system memory **26**. PMM **3** responds that it is willing to sell 250 contracts at 2½ and PRO #**1** responds that it is willing to sell 210 contracts at 2½. No other responses within 30 seconds are received, which is the assumed value of M for the purposes of this example.

The block order and facilitation order process **35** deter-mines that the order is a block order in step **S657**, and in step **S658** that the block order to buy at 2½ can match against responses to sell at 2½ as well as orders and quotations in the book memory **33**.

TABLE XIV

Number of Contracts to sell at 2½	Source
10 CUST	Order in book memory
270 PMM	Quotation in book memory (20)
	Response to message (50)
220 PRO #1	Order in book memory (10)
	Response to message (10)
20 PRO #1	Order in book memory

Table XIV shows that there is a total of 130 contracts available to match against the block order to buy. In step **S662**, it is determined that the order is to buy. In step **S664**, the price of the transaction is determined. In this example, the block order was to buy 500 at 2½. Since there are more than 500 contracts to match at 2½ and no responses or orders and quotation in the book memory **33** at a price lower than the block order price, the execution price is determined to be 2½ and there is nothing to execute at step **S665**. The public customer order for 10 contracts is executed at step **S666**, and the block order and facilitation process **35** applies the allocation algorithm in step **S667** according to the same process illustrated in FIG. **4**(*b*).

TABLE XV

Price	Number of contract of buy	Source
4	10	Order in book memory
3⅞	70	Quotation in book memory (20)
		Response to message (50)
3¾	20	Cust Order in book memory (10)
		Response to message (10)

As an example of how the execution price is determined, assume that a block order to sell 75 at 3¾ is entered. After completing steps **S650** through **S657**, Table XV represents

A154

US 6,618,707 B1

29

the responses and order and quotations to buy. The block order and facilitation process **35** determines that the block order can match in step **S658** and moves through step **S662**. The execution price is determined in step **S668** as the highest price at which the entire order can be matched, which in this example is 3⅞. The order in the book memory to buy at 4 will be executed at 3⅞ first at step **S669** There are no public customer orders at 3⅞, so the process moves through step **S670** to apply in step **S671** the allocation algorithm described above and illustrated in FIG. 5(*b*).

As illustrated in FIG. 11(*c*), the process for execution of facilitation orders trades a defined certain percentage of the original size of the facilitation against to the EAM **9, 11** in steps **S685** and **S693** that entered the facilitation order prior to applying the allocation algorithms illustrated in FIGS. 4(*b*) and 5(*b*) in steps **S687** and **S696** respectively. Further, after completing steps **S687** and **S696**, any remaining unexecuted portion of the facilitation order is traded against the EAM **9, 11** that entered the facilitation order. The percentage of the facilitation order automatically executed against the EAM **9, 11** that entered the facilitation is a value that is stored in the system memory **26**.

Quotation Matching Process

FIG. 13 illustrates the quotation matching process **31**, which introduces a delay before automatically matching a bid and an ask quotation. The idea is to prevent quotations from matching only because one participant's automatic quotation system updates its quotation slightly more quickly than another participant's automatic quotation system. As an example, if there is a quotation in the book memory **33** to buy at 4 and a CMM **7, 5** enters a quotation to sell at 4, the quotation matching process marks the quotation to buy and the quotation to sell in step **S702** and then waits T seconds in step **S704**, T being a variable stored in the system memory **26**. In step **S706**, the process determines whether there exists a bid and an offer that match, since during T quotations may have changes. If there are no matching bids and offers, the marks from step **S702** are removed in step **S708**. If there are bids and offers that match, the process marks those quotations in step **S710** and executes the matching quotations that have two or more marks at step **S712**. The process then returns to step **S704** to again wait T seconds.

The above embodiments are illustrative of the present invention. It is to be understood that the invention is not intended to be limited by this disclosure, but rather is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the invention, as will be apparent to a person of ordinary skill in the art.

I claim:

1. An automated exchange for trading a financial instrument wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:

an interface for receiving an incoming order or quotation to trade the instrument, the incoming order or quotation having a size associated therewith;

book memory means for storing a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith and the previously received orders including public customer orders previously entered for public customers and professional orders or quotations previously entered for one or more professionals;

30

system memory means for storing allocating parameters for allocating trades between the incoming order or quotation and the previously received orders and quotations; and

processor means for allocating portions of the incoming order or quotation among the plurality of previously received orders and quotations in the book memory means based on the allocating parameters in the system memory means, wherein the allocating parameters include parameters for allocating a first portion of the incoming order or quotation against previously received customer orders and allocating a remaining portion of the incoming order or quotation preferentially against professional orders and quotations with larger size.

2. The exchange according to claim 1, wherein processor means further comprises means for matching the remaining portion with professional orders or quotations in the book memory means on a pro rata basis.

3. The exchange according to claim 1, wherein the parameters stored in the system memory further comprise a minimum allocation percentage and wherein the processor means further comprises means for matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker.

4. An automated exchange for trading a financial instrument, wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:

an interface for receiving an incoming order or quotation to trade the instrument, the incoming order or quotation having a size associated therewith;

book memory means for storing a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith and the previously received orders including public customer orders previously entered for public customers and professional orders or quotations previously entered for one or more professionals;

system memory means for storing allocating parameters for allocating trades between the incoming order or quotation and the previously received orders and quotations;

processor means for allocating portions of the incoming order or quotation among the plurality of previously received orders and quotations in the book memory means based on the allocating parameters in the system memory means;

means for matching a first portion of the incoming order or quotation against customer orders and a remaining portion of the incoming order or quotation against professional orders and quotations, wherein the parameters stored in the system memory include a minimum allocation percentage and wherein the processor means further comprises means for matching the remaining portion based on a formula that allocates the minimum allocation percentage of the remaining portion to the quotation identified with the primary market maker, and wherein the minimum allocation percentage is N% and the percentage of the remaining portion allocated to the order identified with the primary market maker is:

$$X\% = \mathrm{Max}[N\%, \mathrm{siz[pmm]}/(\mathrm{siz[pmm]} + \mathrm{siz[pro]})]$$

where siz[pmm] is the size of the order identified with the primary market maker, and size[pro] is the sum of the sizes of the professional orders not identified with the primary market maker.

US 6,618,707 B1

31

32

5. The exchange according to claim 4, wherein the minimum allocation percentage, N%, is a function of the number of professionals having placed previously received orders or quotations.

6. The exchange according to claim 1, wherein the financial instrument is an options contract and wherein the size of an order or quotation is a number of contracts.

7. The exchange according to claim 6, further comprising a clearance entity linked to the processor means for executing a financial transaction to guarantee payment to a seller of the matched order or quotation and to generate a number of new options contracts equal to the size of the matched order or quotation for a purchaser.

8. The exchange according to claim 6, further comprising a reporting entity linked with the processor means for reporting the size and a price of the matched orders and quotations.

9. The exchange according to claim 1, wherein the one or more professionals include one or more broker-dealers.

10. The exchange according to claim 1, further comprising a primary market maker and one or more competitive market makers, the primary market maker and the competitive market makers being professionals and wherein the primary market maker and the competitive market makers enter orders or quotations independently.

11. The exchange according to claim 1, wherein the financial instrument comprises a series of instruments.

12. An automated exchange for trading a financial instrument, wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:

an interface for receiving an incoming order or quotation to trade the instrument, the incoming order or quotation having a size associated therewith;

book memory means for storing a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith and the previously received orders including public customer orders previously entered for public customers and professional orders or quotations previously entered for one or more professionals;

system memory means for storing allocating parameters for allocating trades between the incoming order or quotation and the previously received orders and quotations;

processor means for allocating portions of the incoming order or quotation among the plurality of previously received orders and quotations in the book memory means based on the allocating parameters in the system memory means; and

means for identifying one of the previously received quotations with a primary market maker, wherein the system memory means further comprises means for storing a small order preference limit, and wherein the processor means further comprises means for matching the incoming order or quotation with the previously received quotation identified with the primary market maker if the size of the incoming order or quotation is less than the small order preference limit.

13. An automated exchange for trading a financial instrument, wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:

an interface for receiving an incoming order or quotation to trade the instrument, the incoming order or quotation having a size associated therewith;

book memory means for storing a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith and the previously received orders including public customer orders previously entered for public customers and professional orders or quotations previously entered for one or more professionals;

system memory means for storing allocating parameters for allocating trades between the incoming order or quotation and the previously received orders and quotations; processor means for allocating portions of the incoming order or quotation among the plurality of previously received orders and quotations in the book memory means based on the allocating parameters in the system memory means, wherein the book memory means further comprises

means for ranking the plurality of previously received orders and quotations in order of price from a best price to a worst price, the best price being the highest price order or quotation for purchasing the instrument or the lowest price order or quotation for selling the instrument; wherein the parameters stored in the system memory further comprise

a quotation table associated with at least one of the plurality of previously received quotations at the best price, and wherein the processor means further comprises

means for storing a generated quotation in the book memory means as a previously received quotation at a price one or more minimum trading increments worse than the best price with a size based on the quotation table when all previously received orders and quotations at the best price are matched with the incoming order or quotation.

14. The exchange according to claim 13, wherein the system memory means further comprises means for identifying the quotation table stored in the system memory means with a professional quotation at the best price.

15. The exchange according to claim 13, wherein the quotation table includes a plurality of generated quotation sizes associated with a respective plurality of prices.

16. An automated exchange for trading a financial instrument, wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:

an interface for receiving an incoming order or quotation to trade the instrument, the incoming order or quotation having a size associated therewith;

book memory means for storing a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith and the previously received orders including public customer orders previously entered for public customers and professional orders or quotations previously entered for one or more professionals;

system memory means for storing allocating parameters for allocating trades between the incoming order or quotation and the previously received orders and quotations; and

processor means for allocating portions of the incoming order or quotation among the plurality of previously received orders and quotations in the book memory means based on the allocating parameters in the system

US 6,618,707 B1

33

memory means, wherein the parameters stored in the system memory means further comprise a maximum derived order value and a minimum market size, and, wherein the processor means further comprises

 means for determining that a price for the incoming order or quotation is better than the best price, and,

 means for computing a difference between the size of the incoming order or quotation and the minimum market size, and, if the difference is less than the maximum derived order value, and

 means for deriving an order at the better price and storing the incoming order or quotation and the derived order in the book memory means.

17. The exchange according to claim 16, wherein the processor means further comprises means for matching the incoming order or quotation at the better price with a derived order when the difference is greater than the maximum derived order value.

18. The exchange according to claim 17, wherein the system memory means further comprises means for determining the maximum derived order value based on a price difference between the best price and the better price.

19. The exchange according to claim 18, wherein the means for determining the maximum derived order value is a matrix.

20. The exchange according to claim 16, wherein the parameters stored in the system memory means include a step-up value, and wherein the processor means includes means for deriving an order at the best price when the difference is less than the step-up value.

21. The exchange according to claim 20, wherein the processor means further comprises means for canceling the order or quotation at the best price and means for deriving an order at a price one or more trading increments worse than the best price with a size based on the quotation table when the difference is greater than the step-up value.

22. An automated exchange for trading a financial instrument, wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:

 an interface for receiving an incoming order or quotation to trade the instrument, the incoming order or quotation having a size associated therewith;

 book memory means for storing a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith and the previously received orders including public customer orders previously entered for public customers and professional orders or quotations previously entered for one or more professionals;

 system memory means for storing allocating parameters for allocating trades between the incoming order or quotation and the previously received orders and quotations;

 processor means for allocating portions of the incoming order or quotation among the plurality of previously received orders and quotations in the book memory means based on the allocating parameters in the system memory means; and

 away market querying means for determining an away market price for the instrument, and wherein the processor means determines a best price for the instrument and compares the best price with the away market price, and, if the best price is as good or better than the away market price, the processor means executes the trade.

34

23. The exchange according to claim 22, further comprising an away market process means for entering a matching quotation at the away market price if the processor means determines that the away market price is better than the best price.

24. The exchange according to claim 23, wherein the away market process means computes a difference between the away market price and the best price, and, depending on the difference, enters a quotation at the away market price if the size of the incoming order or quotation is less than or equal to a matching size.

25. The exchange according to claim 24, wherein the away market process means includes a matching table, the matching table including a plurality of price differences and matching sizes.

26. The exchange according to claim 25, wherein the matching table includes larger matching sizes corresponding to smaller differences.

27. The exchange according to claim 23, further comprising alerting means for generating an alert signal if the size is greater than the matching size.

28. An automated exchange for trading a financial instrument, wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:

 an interface for receiving an incoming order or quotation to trade the instrument, the incoming order or quotation having a size associated therewith;

 book memory means for storing a plurality of previously received orders or quotations to trade a corresponding plurality of quantities of the instrument, the previously received orders and quotations each having a size associated therewith and the previously received orders including public customer orders previously entered for public customers and professional orders or quotations previously entered for one or more professionals;

 system memory means for storing allocating parameters for allocating trades between the incoming order or quotation and the previously received orders and quotations;

 processor means for allocating portions of the incoming order or quotation among the plurality of previously received orders and quotations in the book memory means based on the allocating parameters in the system memory means;

 fast market process means for introducing a delay prior to the trade for determining the price for the trade, wherein the fast market process means comprises:

 fast market detecting means for detecting a market volatility and for determining a fast market condition based on that volatility;

 delay means for causing the processor means to pause a predetermined period of time prior to allocating the incoming order or quotation;

 accumulating means for accumulating a plurality of incoming orders and quotations during the predetermined period of time; and

 price determining means for determining a price for trades of the accumulated orders and quotations.

29. The exchange according to claim 28, wherein the fast market detecting means select one of a plurality of fast market levels based on the market volatility and wherein the delay means selects one of a corresponding plurality of periods of time associated with the plurality of fast market levels.

30. The exchange according to claim 28, wherein the price determining means comprises:

US 6,618,707 B1

35

price selecting means for selecting a current price;

order clearance testing means for determining if a trade at the current price would clear all market orders of the plurality of accumulated orders and quotations; and

next price selecting means for selecting a next worse price as the current price.

31. The exchange according to claim 30, wherein the price determining means finds an offer price and a bid price as current prices and further comprises trade price determining means for selecting among the bid price and offer price based on a number of accumulated orders and quotations that would be cleared.

32. The exchange according to claim 31, further comprising tie breaking means for selecting a trade price when the number of accumulated orders and quotations that would be cleared is the same for the bid price and offer price.

33. The exchange according to claim 32, wherein the tie breaking means determines the trade price based on a price movement of a underlying stock.

34. The exchange according to claim 33, wherein the tie breaking means selects the trade price based on a current date.

35. A process for trading a financial instrument on an automated exchange wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the process comprising:

storing a public customer order to trade the instrument in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations entered for one or more professionals to trade the instrument in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the instrument;

establishing an allocating parameter;

receiving an incoming order or quotation for the purchase or sale of the instrument, the incoming order or quotation having a size associated therewith;

first matching a first portion of the incoming order or quotation against the public customer order stored in the book memory based on the allocating parameter; and

second matching a remaining portion of the incoming order or quotation preferentially against professional orders and quotations with larger size based on the allocating parameter.

36. The process according to claim 35, wherein the step of second matching further comprises allocating the remaining portion among the plurality of professional orders and quotations on a pro rata basis.

37. The process according to claim 35, wherein the professional orders and quotations are stored by one or more broker-dealers.

38. The process according to claim 35, wherein the professional orders and quotations are stored by a primary market maker and one or more competitive market makers, the primary market maker and the competitive market makers being professionals and wherein the primary market maker and the competitive market makers enter orders or quotations independently.

39. The process according to claim 35, wherein the financial instrument comprises a series of instruments.

40. A process for trading a financial instrument on an automated exchange wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the process comprising:

36

storing a public customer order to trade the instrument in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations entered for one or more professionals to trade the instrument in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the instrument;

establishing an allocating parameter;

receiving an incoming order or quotation for the purchase or sale of the instrument, the incoming order or quotation having a size associated therewith;

matching the incoming order or quotation against the orders and quotations stored in the book memory based on the allocating parameter;

identifying one of the professional quotations with a primary market maker, wherein the allocating parameter includes a small order preference limit, and wherein the step of matching further comprises:

determining that the size of the incoming order or quotation is less than or equal to the small order preference limit; and

matching the incoming order or quotation with the professional quotation identified with the primary market maker.

41. The process according to claim 40, wherein the allocating parameter includes a minimum allocation percentage and wherein the step of matching further comprises:

determining an allocation formula based on the minimum allocation percentage; and

matching the incoming order or quotation with the professional orders and quotations based on the allocation formula.

42. A process for trading a financial instrument on an automatic exchange wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the process comprising:

storing a public customer order to trade the instrument in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations to trade the instrument in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the instrument;

establishing an allocating parameter, wherein the allocating parameter includes a small order preference limit and a minimum allocation percentage;

identifying one of the professional quotations with a primary market maker;

receiving an incoming order or quotation for the purchase or sale of the instrument, the incoming order or quotation having a size associated therewith;

first matching a first portion of the incoming order or quotation with the customer order;

clearing the customer order matched with the first portion from the book memory;

determining that the size of the incoming order is less than or equal to the small order preference limit;

determining an allocation formula based on the minimum allocation percentage; and

matching the remaining portion with the professional orders and quotations based on the allocation formula, wherein the minimum allocation percentage is N% and the allocation formula is:

US 6,618,707 B1

37

$X\% = \text{Max}[N\%, \text{siz}[pmm]/(\text{siz}[pmm]+\text{siz}[pro])]$,

where siz[pmm] is the size of the order identified with the primary market maker, and siz[pro] is a sum of order sizes identified with the professionals other than the primary marker maker.

43. The process according to claim 35, wherein the financial instrument is an options contract and wherein a size of an order or quotation is a number of contracts.

44. The process according to claim 43, further comprising:

transmitting a message to a clearance entity reporting a price and size of the order or quotation matched in the steps of first and second matching;

executing a financial transaction by the clearance entity to guarantee payment to a seller of the matched order or quotation; and

generating a number of new options contracts by the clearance entity equal to the size of the matched order or quotation for a purchaser.

45. The process according to claim 43, further comprising transmitting a message to a reporting entity communicating the size and price of the order or quotation matched in the steps of first and second matching.

46. A process for trading a financial instrument on an automated exchange wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the process comprising:

storing a public customer order to trade the instrument in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations entered for one or more professionals to trade the instrument in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the instrument;

establishing an allocating parameter; receiving an incoming order or quotation for the purchase or sale of the instrument, the incoming order or quotation having a size associated therewith;

establishing a quotation table;

determining that orders stored in the book memory at the best price have been exhausted; and

storing a generated quotation in the book memory at a price one or more trading increments worse than the best price with a size based on the quotation table.

47. The process according to claim 46, further comprising identifying the quotation table with a quotation stored in the book memory.

48. The process according to claim 47, wherein the quotation table includes a plurality of successive prices.

49. A process for trading a financial instrument on an automated exchange wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the process comprising:

storing a public customer order to trade the instrument in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations entered for one or more professionals to trade the instrument in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the instrument;

establishing an allocating parameter;

receiving an incoming order or quotation for the purchase or sale of the instrument, the incoming order or quotation having a size associated therewith;

38

matching the incoming order or quotation against the orders and quotations stored in the book memory based on the allocating parameter, wherein the allocating parameter includes a maximum derived order value;

determining that a price of the incoming order or quotation is better than the best price;

determining that a size of the incoming order or quotation is less than a minimum market size;

calculating a difference between the size of the incoming order or quotation and the minimum market size;

determining that the difference is less than the maximum derived order value; and

storing a quotation in the book memory at the better price with a size equal to the difference.

50. The process according to claim 49, further comprising:

determining that the difference is greater than the maximum derived order value; and

matching the incoming order or quotation with a primary market maker quotation at the better price.

51. The process according to claim 49, further comprising determining the maximum derived order value based on a price difference between the best price and the better price.

52. The process according to claim 51, wherein the step of determining the maximum derived order value further comprises retrieving a matrix.

53. A process for trading a financial instrument on an automated exchange wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the process comprising:

storing a public customer order to trade the instrument in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations entered for one or more professionals to trade the instrument in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the instrument;

establishing an allocating parameter;

receiving an incoming order or quotation for the purchase or sale of the instrument, the incoming order or quotation having a size associated therewith; matching the incoming order or quotation against the orders and quotations stored in the book memory based on the allocating parameter, wherein the allocating parameter includes a step-up value and a minimum market size;

determining that a size of orders and quotations at the best price is less than the minimum market size;

calculating a difference between the size of orders and quotations at the best price and the minimum market size;

determining that the difference is less than the step-up value; and

deriving an order.

54. The process according to claim 53, wherein the size of the derived order equals the difference.

55. The process according to claim 54, wherein the allocating parameter includes a quotation table, and wherein the process further comprises:

determining that the difference is greater than the step-up value;

canceling a professional order or quotation at the best price; and

deriving an order for a professional at a price one or more trading increments worse than the best price with a size determined from the quotation table.

A159

US 6,618,707 B1

39

56. A process for trading a financial instrument on an automated exchange wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the process comprising:

storing a public customer order to trade the instrument in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations entered for one or more professionals to trade the instrument in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the instrument;

establishing an allocating parameter;

receiving an incoming order or quotation for the purchase or sale of the instrument, the incoming order or quotation having a size associated therewith;

matching the incoming order or quotation against the orders and quotations stored in the book memory based on the allocating parameter;

querying an away market to determine an away market price;

comparing the best price with the away market price; and, if the best market price is as good or better than the away market price,

executing the step of matching.

57. The process according to claim **56**, wherein, if the step of comparing determines that the away market price is better than the best price, further comprising:

computing a price difference between the best price and the away market price;

determining a size of the trade;

determining a matching size based on the difference; and

matching the incoming order or quotation at the away market price if the size of the incoming order or quotation is less than the matching size.

58. The process according to claim **57**, wherein the step of querying further comprises receiving market price information from a reporting entity.

59. The process according to claim **58**, wherein the step of determining the matching size further comprises reading an away market matching table, the matching table including a plurality of matching sizes associated with a corresponding plurality of price differences.

60. The process according to claim **59**, wherein smaller price differences in the matching table are associated with larger matching sizes.

61. The process according to claim **57**, wherein if the size of the incoming order or quotation is greater than the matching size, further comprising generating an alert signal.

62. A process for trading a financial instrument on an automated exchange wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the process comprising:

storing a public customer order to trade the instrument in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations entered for one or more professionals to trade the instrument in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the instrument;

establishing an allocating parameter;

receiving an incoming order or quotation for the purchase or sale of the instrument, the incoming order or quo-

40

tation having a size associated therewith; matching the incoming order or quotation against the orders and quotations stored in the book memory based on the allocating parameter;

determining that a fast market condition exists;

accumulating a plurality of incoming orders and quotations for a predetermined period of time;

determining a trade price for trades of the accumulated orders and quotations; and

matching the accumulated orders and quotations at the determined trade price after the predetermined period of time.

63. The process according to claim **62**, further comprising:

establishing a plurality of fast market levels;

establishing a plurality of predetermined periods of time corresponding to the fast market levels;

determining which fast market level corresponds to the fast market condition; and

accumulating incoming orders and quotations for a period of time corresponding to the determined fast market level.

64. The process according to claim **62**, wherein the step of determining the trade price comprises:

determining which of the accumulated orders are market orders;

determining that the predetermined period of time has expired;

bid selecting a highest bid price of the orders on the book that are bids as a current bid price;

bid predicting whether all the market orders that are bids will trade at the current bid price;

if all market orders that are bids will not trade at the current bid price, selecting a next worse price as the current bid price and repeating the steps of bid predicting and bid selecting until the current bid price equals a primary market maker bid price;

offer selecting a lowest offer price of the orders on the book that are offers as the current offer price;

offer predicting whether all the market orders that are offers will trade at the current offer price;

if all the market orders that are offers will not trade at the current offer price, selecting a next worse price as the current offer price and repeating the steps of offer predicting and offer selecting until the current offer price equals a primary market maker offer price; and

selecting from among the current bid price and current offer prices a trade price that maximizes a number of orders traded.

65. The method according to claim **64**, further comprising:

determining that the current offer price and current bid price will result in the same number of orders traded;

determining that a number of trading increments between the current offer price and the current bid price is an even number; and

establishing the trade price as the average of the current bid price and current offer price.

66. The process according to claim **64**, wherein the financial instrument is an option contract and further comprising:

determining that the number of trading increments between the current bid price and current offer price is one;

US 6,618,707 B1

41

determining a price movement of an underlying stock;

if the stock movement is upward, selecting the current offer price as the trade price for call options and the current bid price as the trade price for put options; and

if the stock movement is downward, selecting the current bid price as the trade price for call options and selecting the current offer price as the trade price for put options.

67. The process according to claim 66, further comprising:

determining that the stock movement is neither upward nor downward; and

selecting the trade price based on a current date.

68. A process for trading option contracts on an automatic exchange wherein the trade may be one of a purchase of a quantity of the contracts and a sale of a quantity of the contracts, the process comprising:

storing a public customer order to trade the contracts in a book memory, the public customer order having a size;

storing a plurality of professional orders or quotations to trade the contracts in the book memory, the professional orders or quotations having a respective plurality of sizes;

establishing a best price for the contracts;

establishing an allocating parameter;

receiving an incoming order or quotation for the purchase or sale of the contracts, the incoming order or quotation having a size associated therewith;

determining that a fast market condition exists;

accumulating a plurality of incoming orders and quotations for a predetermined period of time;

determining which of the accumulated orders are market orders;

determining that the predetermined period of time has expired;

bid selecting a highest bid price of the orders on the book that are bids as a current bid price;

bid predicting whether all the market orders that are bids will trade at the current bid price;

if all market orders that are bids will not trade at the current bid price, selecting a next worse price as the current bid price and repeating the steps of bid predicting and bid selecting until the current bid price equals a primary market maker bid price;

offer selecting a lowest offer price of the orders on the book that are offers as the current offer price;

offer predicting whether all the market orders that are offers will trade at the current offer price;

if all the market orders that are offers will not trade at the current offer price, selecting a next worse price as the current offer price and repeating the steps of offer predicting and offer selecting until the current offer price equals a primary market maker offer price;

determining the number of trading increments between the current bid price and the current offer price is greater than one;

calculating a value, N, which is the number of trading increments between the current bid price and the current offer price minus two;

if the stock movement is upward, selecting the current offer price minus N trading increments as the trade price for call options, and the current bid price plus N

42

trading increments as the trade price for put options; and if the stock movement is downward, selecting the current bid price plus N trading increments as the trade price for call options and the current offer price minus N trading increments as the trade price for put options; and

matching the incoming order or quotation against the orders and quotations stored in the book memory based on the allocating parameter.

69. The process according to claim 68, further comprising:

determining that the stock movement is neither upward nor downward; and

selecting a trade price based on a current date.

70. An automated exchange for trading a financial instrument, wherein the trade may be one of a purchase of a quantity of the instrument and a sale of a quantity of the instrument, the exchange comprising:

a book memory adapted to store a quotation for purchasing or selling the financial instrument, the quotation having a size associated therewith;

an interface adapted to receive an incoming order for the purchase or sale of the instrument, the incoming order being associated with one of a plurality of types of entities and having a size associated therewith, wherein the types of entities include public customers, professionals, and market makers on other exchanges; and

a processor including:

a discriminator adapted to determine which of the plurality of types of entities the incoming order is associated with;

a system memory adapted to store a set of preference quantities, the preference quantities being associated with respective ones of the plurality of entity types; and

a trade matching process adapted to execute the trade between a portion of the quotation and the incoming order and wherein a size of the portion is based on the preference quantity associated with the entity type determined by the discriminator.

71. The exchange according to claim 70, wherein one or more of the preference quantities are an absolute quantity of the instrument.

72. The exchange according to claim 70, wherein one or more of the preference quantities are a percentage of the size of the quotation.

73. The exchange according to claim 70, wherein the preference quantity is the lesser of an absolute quantity and a percentage of the size of the quotation.

74. The exchange according to claim 70, wherein the book memory is adapted to store a second quotation, wherein the system memory is adapted to store a plurality of second preference quantities, and wherein the trade matching process trades the incoming order against the portion of the quotation and a second portion of the second quotation, sizes of the portion and the second portion based on the respective preference quantity and second preference quantity.

75. The exchange according to claim 70, wherein the preference quantity is associated with the customer and wherein the size of the portion equals the size of the quotation.

* * * * *

A160.1

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO.   : 6,618,707 B1   Page 1 of 1
DATED   : September 9, 2003
INVENTOR(S)   : Gary Katz

It is certified that error appears in the above-identified patent and that said Letters Patent is
hereby corrected as shown below:

Title page,
Item [12], change "**Gary**" to -- **Katz** --.
Item [75], Inventor, change "**Katz Gary**" to -- **Gary Katz** --.

Column 30,
Line 24, change "the quotation" to -- a quotation --.
Line 25, change "the primary market maker" to -- a primary market maker --.
Line 57, change "remaining portion to the" to -- remaining portion to a --.
Line 58, change "the primary market marker" to -- a primary market maker --.

Column 33,
Line 10, delete "and"

Signed and Sealed this

Twentieth Day of January, 2004

JON W. DUDAS
Acting Director of the United States Patent and Trademark Office

A160.2

PROOF OF SERVICE

I, Parker H. Bagley, hereby certify that on July 1, 2013, I transmitted the foregoing nonconfidential version of **Brief of Appellant** to the Clerk of the United States Court of Appeals for the Federal Circuit through the Court's CM/ECF filing system. Also on that date, I certify that the following counsel of record were served via the CM/ECF system:

Brian J. Doyle
Fish & Richardson, P.C.
601 Lexington Avenue
52nd Floor
New York, NY 10022
Email: byd@fr.com

Leah A. Edelman
Fish & Richardson, P.C.
601 Lexington Avenue
52nd Floor
New York, NY 10022
Email: edelman@fr.com

David R. Francescani
Fish & Richardson, P.C.
601 Lexington Avenue
52nd Floor
New York, NY 10022
Email: drf@fr.com

Stacie Rachel Hartman
Schiff Hardin LLP
233 S. Wacker Drive
6600 Sears Tower
Chicago, IL 60606
Email: shartman@schiffhardin.com

Jeffrey Chuang-Wei Mok
Fish & Richardson, P.C.
601 Lexington Avenue
52nd Floor
New York, NY 10022
Email: jmok@fr.com

Frank Porcelli
Fish & Richardson, P.C.
One Marina Park Drive
Boston, MA 02210
Email: fpp@fr.com

Michael T. Zoppo
Fish & Richardson, P.C.
601 Lexington Avenue
52nd Floor
New York, NY 10022
Email: mtz@fr.com

Dated: July 1, 2013

By: s/ Parker H. Bagley

CERTIFICATE OF COMPLIANCE

I hereby certify that this principal brief complies with the type-volume limitation of Fed. R. App. P. 32(a)(7)(B) because the brief contains 13,643 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(a)(7)(B)(iii) and Fed. Cir. R. 32(b).

I further certify that the foregoing brief complies with the typeface and type style requirements of Fed. R. App. P. 32(a)(5) and (6), as well as Local Rule 32(b), because it has been prepared in a proportionally spaced typeface in 14-point Times New Roman font.

July 1, 2013   /s/Parker H. Bagley
      Date   Parker H. Bagley

                                      Attorney for Appellant International
                                      Securities Exchange, LLC